SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1889, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LX.—No. 14.] ESTABLISHED 1845. NEW YORK, APRIL 6, 1889. [$3.00 A YEAR. WEEKLY.

THE ARTESIAN WELLS OF THE JAMES RIVER VALLEY, DAKOTA.

L. F. KORNS.

The James River Valley is one of the remarkable agricultural valleys of the country. The valley proper extends from Yankton on the south to Jamestown on the north, a distance of 300 miles. Most of this vast area is level. Entire townships can be plowed without a single obstruction to the plow.

This ideal agricultural valley was strangely passed by until about 1880. At this date the buffalo had gone farther west; but when the writer visited this valley early in the eighties, the prairie was dotted white with the bones of this noble animal.

The early pioneer found the most of Dakota inclined to drought, caused largely by extensive fires which left the surface bare. This caused drought, but since the protection of the grasses by settlement, moisture has so increased that this valley is now teeming with productive farms. This valley greatly resembles the valley of the Nile, but unlike that historic region has its surplus of water beneath instead of at the surface.

It is the greatest artesian well district known. A comparison with other districts will show that for pressure and area over which they are found, this valley far surpasses them all. There are some fine wells in France, but they are found only in favored localities. Some of the wells in France are of large bore, but in none does the pressure equal any one of fifty wells in the James Valley. Western California, from San Diego to near the northern boundary of the State, is proving itself to be a fine artesian district, but strong pressure is found only in limited areas. Nearly every city and many of the small villages from Yankton to Jamestown have wells, and the majority of these have a very heavy pressure.

The pioneer well was put down at Aberdeen, March, 1882, by the C., M. & St. P. R.R. Co. It is 961 feet deep, with a tube 5½ inches, made of 3-16 inch wrought iron. Water was found in sand rock. The water is soft, but cannot be used in boilers, as it foams. This well choked up with sand for a time, but afterward opened with its original force.

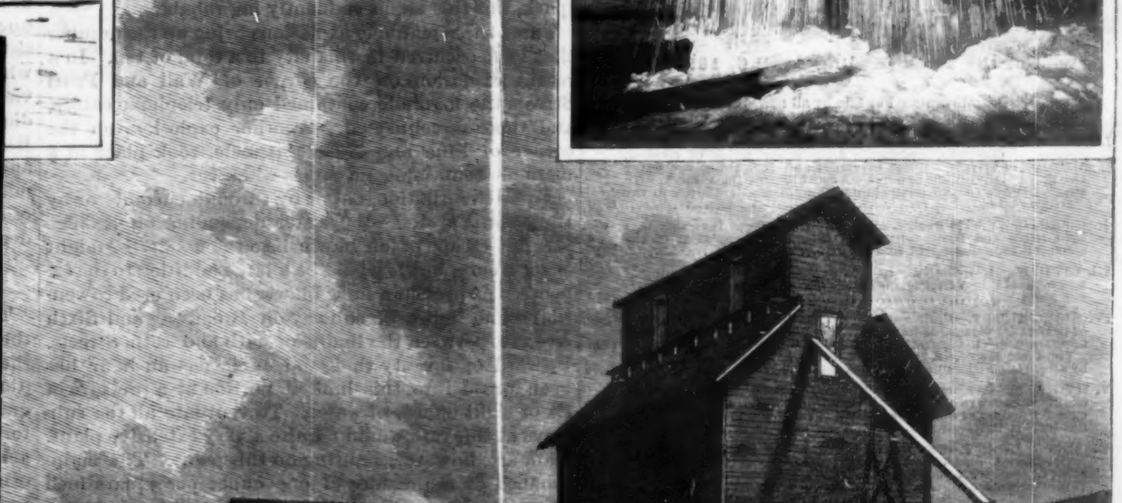
In 1884 the city put down a well 908 feet deep, 5$\frac{5}{16}$ inch tube. A system of water works was put in. The city, with 5,000 inhabitants, has the best of fire protection. Four streams at one time can be thrown over the highest of buildings. Aberdeen and surrounding country are very level, so to get drainage a pumping system, such as Pullman, Ill., has, became necessary. Last year the city put down a well for power alone. The system is now completed, and the result is perfect. The pumps have a capacity of 50,000 gallons per hour. A float makes the pumps automatic, so that they work only when there is sewage to be raised. For a cost of only a few thousand dollars this city has water

(Continued on page 213.)

Fire Service at Yankton.

Natural Flow through 6 inch Pipe of Yankton Well.

Well at Redfield. Depth, 960 feet.



Well at Aberdeen. Pressure, 300 lb. per square inch.

THE WONDERFUL ARTESIAN WELLS OF DAKOTA.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.................. $3 00
One copy, six months, for the U. S. or Canada.................. 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of seven dollars.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, APRIL 6, 1889.

Contents.

(Illustrated articles are marked with an asterisk.)

Appliances, railway 218
Appointments, be prompt in 214
Blue, Prussian, solvents of 213
Board, foot, for wood choppers, Stevens* 210
Brake, vehicle, Fraser's* 210
Bronze, deoxidized 213
Bright, John 208
Business and personal 218
Cars, funeral 214
Carriage, book, Leith's* 211
Cotton and wool 214
Cedrus deodora 210
Distributer, fertilizer, Greaves'* 210
Engineering, electrical, at Princeton 209
Equalizer, draught, improved* 210
Exhibition, Paris 209
Exhibition, Paris, exhibits for 208
Explosions, electric subway 208
Holes, blasting, to plant trees 215
Industry, German, promoting 217
Inkstand, Davis'* 215
Inventions, agricultural 218
Inventions, mechanical 218
Inventions, miscellaneous 218
Inventions increase employment 215
Inventions, index of 219
Japan 212
Jar, Leyden, discharge of 212
Jupiter, occultation of 213
Latrobe, John H. B.* 214
Loom, the 217
Milling, what invention has done for 216
Niagara Falls, changes at 216
Notes and queries 218
Notes, photographic 212
Organs, internal, illuminating 211
Ostrich farming in California* 211
Patents, storage battery 214
Poacher, egg, Littleton's* 211
Pipes, wrought iron 212
Press, seal, Strodtman's* 215
Proctor, Prof., the late 213
Proctor, Mrs., pension for 208
Rubber, some facts about 216
Science, paradoxes of 217
Service, fire, at Yankton* 207
Ships, war, English 218
Shovel, snow, Fairweather's* 210
Sound, experiments in* 217
Square, try and center, Chaplin* 211
Squirrel, industrious 217
Stars, shooting, light of 217
Structures, high, oscillation of 209
Trap, drainage, Shaw's* 215
Turret, Monitor, inventor 216
Well at Aberdeen* 207
Well at Redfield* 207
Well at Yankton* 207
Welding, electric 215
Wells, artesian, of Dakota* 207
Wells, gas, deep 214

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 692.

For the Week Ending April 6, 1889.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—Irrigation in Colorado.—A review of the canal system of Colorado, embracing 5,000 linear miles of ditches, $12,000,000 of private capital invested, and furnishing water for two and a half millions of acres.—A most interesting subject, with suggestions as to the advisability of applying irrigation in the Eastern States 11061

II. CHEMISTRY.—Hydrazine.—The result of recent investigations by Curtius and Lang considered, giving the properties of the strongest reducing agent known 11057

III. CIVIL ENGINEERING.—La Guaira Harbor.—Official opening of a new harbor in Venezuela.—The docks, stores, and other wharfage plant 11051

IV. ELECTRICITY.—Resistance of Peanut Oil.—Curious properties of peanut oil as regards its variation of electrical resistance with temperature.—A suggestion for an electric thermometer 11057
The Tesla Motor.—A short description of the Tesla motor, driven by alternating currents.—1 illustration 11053

V. HYGIENE.—Gymnastic Exercises and Apparatus.—Continuation of this exhaustive article, with very full illustrations, including a cure for penman's cramp and other special applications of gymnastics.—11 illustrations 11056

VI. METALLURGY.—The Heat Treatment of Steel.—By HENRY M. HOWE.—A most valuable and interesting lecture on the metallurgy of steel with very full details, illustrations, and diagrams.—17 illustrations 11054

VII. METEOROLOGY.—The Exhibition of the New England Meteorological Society.—A short description of the apparatus exhibited in the Massachusetts Institute of Technology last January, including registering and meteorological apparatus in general, new methods of reaching data, and some curiosities in this line 11061

VIII. MICROSCOPY.—Clinical Study of Bacteria.—By A. CLIFFORD MERCER, M.D.—A suggestion for the microscopist as regards the examination of bacterial and other matter liable to occur in clinical study 11057

IX. MISCELLANEOUS.—A California Banyan Tree.—Note of immense California tree 11057
Capture of a Devil Fish.—Capture of a so-called devil fish or gigantic skate, with graphic illustration of its lowering on deck.—1 illustration 11060

X. NAVAL ENGINEERING.—A Fast Steam Launch.—A new steam launch recently built in England of very high speed, destined for passenger traffic in India.—5 illustrations 11051
H. M. S. Victoria.—Abstract of the size, speed, armament, and other details of the new first-class battle ship.—2 illustrations 11047
The Propelling Machinery of Modern War Vessels.—By H. J. ORAM.—A very important and valuable paper on this mooted question, treating of the different varieties of draught, ratio of main and auxiliary steam engines, etc 11047

XI. PHOTOGRAPHY.—Photographic Chemicals and their Impurities.—The impurities of alkaline salts, with special reference to sodium carbonate 11060

XII. PHYSICS.—A New Polarimeter.—New apparatus lately described for the Physical Society of London, by Prof. SILVANUS B. THOMPSON, for the study of polarized light 11059

XIII. TECHNOLOGY.—A Smoke Consuming Furnace.—A new furnace of revolving type for the consumption of its own smoke, utilizing a vertebrated Archimedean screw.—3 illustrations 11062
Liquid Fuel.—By M. J. FRANCISCO.—A plea for the utilization of liquid fuel on a larger scale, with special application to electric installations 11062

ELECTRIC SUBWAY EXPLOSIONS.

On March 25, a serious explosion occurred in this city, which emphasized the danger that seems inherent in the electric subways in cities. Three manholes in the vicinity of Fifth Avenue and Twenty-third Street were blown up by explosions undoubtedly due to the ignition of a mixture of illuminating gas and air. The explosions occurred a little before noon; three hours previously the manholes had been opened. Any leakage of gas into the subway must have occurred during those three hours, unless it found its way from other parts of the subway to the particular manholes which exploded. The effects of the explosion were to lift off the heavy cap with its double covering plates that shut in the top of the manhole. These parts weigh about 1,600 lb. The upper, loose plates, that are flush with the surface of the road, were thrown to one side; the lower plates, held each to its seat by a screw and cotter bar, were not displaced to the same extent, but rose with the iron cap or curb and settled back with it. One of the manholes was cracked down the four corners. No serious damage to person or private property ensued. The subway lines were quite uninjured. Men working in adjacent manholes were undisturbed.

The manholes are brick-lined pits about five feet square and eight feet deep, the size varying according to the requirements of each case. They are placed at varying intervals; in the present instance the three exploding ones were within two hundred feet of each other. From manhole to manhole run rows of iron pipes embedded in solid concrete; the pipes are generally of 2½ or 3 inches internal diameter, and have screwed joints. The electric cables, of about two inches diameter, are passed through the numerous ducts thus provided, leaving a small portion open to the transmission of air or gas. The ducts may safely be assumed to be gas tight. The manholes, constructed of masonry with the greatest care, are far from being as impervious as the iron pipes. Their capacity may be put at 200 cubic feet each one. Six per cent of gas, equivalent for this volume to 12 cubic feet, mixed with the entire volume of air in one manhole would produce an explosive mixture. The top of the manhole is tightly closed, the inner lid being forced down by the central screw against a rubber gasket. In three hours ample time would be afforded for 12 cubic feet of gas to accumulate in a manhole if there were any crevices or open pores. But the tightness of the cover, which renders the accumulation possible and easy, makes the cause of the explosion a mystery. A mixture of gas and air can only be exploded by heat; concussion is without effect; spontaneous combustion is impossible as far as known; external ignition from a cigar or match seems impossible, on account of the tightly fitting lid; the most obvious cause would seem to be an electric static discharge or an arc. But in the case of the exploding manholes, all the cables were dead or had no current passing; it is not possible to trace any plausible origin of a spark to them. Disturbances of the electric equilibrium between atmosphere and earth has been suggested as the cause of the production of a minute spark, but this seems eminently improbable.

These three manhole explosions bring up the number that have occurred in this city to a total of ten. In a recent explosion on the corner of Wall and Pearl Streets the manhole contained only telephone cables, and those disconnected. Another explosion, on the corner of Pine and Nassau Streets, took place in a manhole containing no cables whatever.

Forced ventilation, either by through currents or by the *plenum* system—the latter depending on leakage for the escape of air blown into the conduits—might effect a cure, but it would be a large addition to the expense. At present a force blower has been used to ventilate four miles of subway on Broadway and Sixth Avenue, between the limits of 14th and 59th Streets. Upward of seventy thousand cubic feet an hour has been forced into this limited portion at a pressure of six or eight ounces of water. To ventilate all the subways at this rate would require a very extensive plant. Data are, however, wanting on this point. The maintenance of a pressure of one ounce per square inch throughout the system would undoubtedly exclude gas. Natural ventilation of each manhole has also been suggested.

In other cities far worse results in the way of explosions have followed the introduction of subways. In Chicago, pieces of an iron cover were projected into the second story of the Board of Trade building. Another explosion occurred just as a steam fire engine was over the manhole, and was so violent as to overturn the engine. This indicates a degree of violence that is capable of doing as much harm as has ever been done by overhead cables. Explosions in New York have been less violent. A correct policy has undoubtedly been followed in adopting as tightly closed a system as possible, with very heavy iron caps for the manholes.

If the lead coatings of the cables were insulated, the conditions for a static discharge from core to sheathing would be often liable to occur. But lying for the most part in iron pipes, bedded in concrete, it has been assumed that the outer coatings were so efficiently grounded that the Leyden jar condition could not well exist. In cables laid in the asphalt conduit, where insulation was especially sought for and stipulated for in the contracts, the conditions for static discharge might readily exist. But now an exactly opposite line of work is followed, and the grounding of the lead coatings of the cables is considered a definite advantage.

Bids have recently been opened in this city for the maintenance of electric street lamps. The companies generally gave two figures, one for overhead service, the other, greatly in excess, for underground distribution. This comes as an additional blow at the subway system, for it was justly or unjustly seized upon as a pretext for higher prices. A special meeting for April 1 of the Board of Electrical Control has been called by the Mayor, to which representatives of the gas companies have been invited, to confer upon the question of subway explosions.

It may be that some light will be shed upon this subject at this meeting, which we regret is to be held after we go to press.

John Bright.

John Bright, the eminent parliamentarian and radical leader of England, died at 8 o'clock on the morning of March 27. The funeral was fixed for the 30th, and was as quiet as possible. He was born at Greenbank, Rochdale, November 16, 1811. His father was a weaver, his mother was a tradesman's daughter. He was one of eleven children. His father had started a mill two years before the birth of his eminent son, and this laid the foundation of a fortune, something that in England is a very powerful adjunct to a successful political career. John Bright received a plain education, and entered his father's mill. He was called upon in 1831 to move a vote of thanks to a popular lecturer who had appeared in his town. This was his first speech, soon followed by another on the temperance question, and before long the discovery was made of oratorical abilities hitherto unsuspected. In 1841 his attention was called by Mr. Cobden, the great free trader, to the corn laws. For five years, 1841–46, he labored in partnership with Cobden in this cause, speaking on a great number of occasions. In the heat of this agitation, in 1843, he was elected to Parliament. In the fall of 1857, he was elected from Birmingham, and that city has been his political home. It was in the early part of this year that his opposition to the Crimean war caused his defeat as a candidate for Manchester. During the war between the States he espoused the Northern side, principally, it is supposed, on account of his dislike to slavery, as he was on principle a confirmed opponent of the arbitrament of war. A strict radical in English politics, he adopted the other side on the Irish question, and for the last eight or ten years has figured as a pronounced Unionist. He voted for the Gladstone coercion bills, making his record in Irish politics the reverse of his English career. It is true that the efforts, however radical, of Mr. Bright's life were always well within constitutional limits, so that he had some grounds, or at any rate an excuse, for objecting to the unconstitutional methods of agitation adopted in the sister island. He was pre-eminently an Englishman, which probably gives the true reason for his opposite views where England and Ireland were concerned. He died as the representative of a Birmingham district. His powers of repartee and sarcasm were very great, and as a speaker he was peculiarly effective, and many interesting instances of the ever-varying phases of his oratory are preserved in the records of the latter decades.

A Pension for Mrs. Proctor.

The numerous readers of Mr. Proctor's works, says the *English Mechanic*, will be pleased to learn that the Queen, on the recommendation of Mr. W. H. Smith (the First Lord of the Treasury), has been pleased to grant a Civil List pension of £100 a year to Mr. Proctor's widow, who is now in Florida. Mr. Smith's action was prompted by a memorial signed by many others besides men of science. Among the well known names attached to the memorial are those of the Duke of Argyll, Earl of Crawford, Lord Grimthorpe, Profs. Tyndall and Huxley, Sir John Lubbock, Sir L. McClintock, Sir R. S. Ball, Prof. Piazzi Smyth, Drs. Copeland and Huggins, Cols. Tupman and J. Herschel, Messrs. Clements Markham, Grant Allen, and Warren de la Rue.

THE Secretary of the Treasury gives notice that manufactures, articles, or wares produced or manufactured in the United States, which may be sent to the Paris exhibition of 1889 for exhibition, will, upon their return to the United States, be admitted to free entry.

Paintings and other works of art, the production of foreign schools of art, which may be now owned in this country by residents of the United States, and which may be loaned to the French Department of Fine Arts of said Paris exhibition of 1889, for exhibition, will also, upon their return to the United States, be exempted from payment of duty.

The Paris Exhibition.

[SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN.]

PARIS, March 6, 1889.

ASCENT OF THE EIFFEL TOWER.

I ascended the Eiffel Tower to-day to a height of about 850 feet, and as the greater part of the ascent is made up a spiral staircase winding around an iron column of about 16 inches in diameter, the task is no mean one, as may be judged from the fact that the workmen are allowed three-quarters of an hour to accomplish it. Nobody but an engineer can be expected to find much beauty in the tower as viewed from the interior, since it presents nothing but a network of girders, except perhaps on the first platform, upon which there are various alcoves now being roofed in, and which afford a pleasant relief to the eye. Similar alcoves are to be constructed on the second platform, but they have as yet no visible existence from the interior.

It is after the second platform is passed that the prominent individuality of the tower makes itself apparent, since one has, as he ascends, a spiral panorama, as it were, before him and the proportions of the various buildings in the surrounding city begin to lose their importance as one ascends, until at last a cottage becomes the equal of a mansion. At 800 feet from the ground, the spires of churches and the towers of the Trocadero appear of very little more consequence than the chimneys of some of the taller buildings, and the Eiffel Tower seems to be the one important thing in Paris, the whole of which, with the country beyond, lies within the sweep of the eye upon a clear day.

The efforts of the public to gain admission to the buildings and grounds are very numerous and persistent, particularly with regard to the Eiffel Tower, and it is but fair to say that the officials of the Bureau of Exploitation are courteous, business-like, and *prompt to a degree;* while, when, as in a very large number of cases, it is necessary to decline to give passes, it is done in so courteous and reasonable a manner that the disappointed ones cannot feel aggrieved. The passes are good for one day only, those for the Eiffel Tower being separate and distinct from those for the buildings.

The ornamentation of the tower has scarcely yet begun, nor has work on the elevators as yet progressed sufficiently to make itself apparent. The tower itself will doubtless be completed by May 5, although the elevators and the ornamentation may not be complete; and if the prices of admission are wisely chosen, the number of visitors will be very large. At this present writing there does not seem any hurry in the operations on the tower; indeed, one feels disappointed to find so few workmen at work, but then, of course, the full height is nearly attained, and so far as what may be termed the framework of the structure is concerned, the end is in view, and completion can doubtless be rapidly achieved.

As viewed from the exterior, the tower possesses many or at least several individualities. For example, viewed from a distance, one cannot tell what the shape of the tower is above the height of about 500 feet, and the reason is that the light of course shows through it, thus eliminating the shadows that usually guide the eye in determining the form of a distant building. The impression is that the upper part is round, or from some points of vision it seems as though it was octagonal. It would appear to be round from any distant point, or say any point more than 400 yards distant, but for the fact that the girders do not interlace enough at the sides to warrant a mechanical eye in accepting the shape as circular; an ordinary spectator, however, would without hesitation take it as being so.

The light, in passing through the tower, renders it much less imposing than it would be if it were solid, while, when one is close to it, or rather directly beside it, it does not seem so imposing as the Washington Monument, at Washington, D. C., which occurs because the base is spread, and one cannot, therefore, see the upper part when standing close to the base.

Evidences of the handwork or brainwork of American engineers are to be very frequently found here on machines of French make; for example, all three of the hoisting engines on the platforms of the tower have Porter governors on them.

While on this subject of engines, let me say that, so far as locomotives are concerned, it is hard to see what is to be gained by exhibiting American locomotives here, except in so far as the colonial trade is concerned, as there are some important elements in the conditions under which locomotives are used in the United States that do not obtain here. For example, the coal used here does not require so much draught; hence there is no need to employ adjustable nozzles to the cylinder exhaust pipes, or to in any way contract the exhaust.

The French, as well as the English, employ copper for their fireboxes, and use also copper stays. The Chemin de Fer du Nord do not use any steel boilers, and I have found some English engineers who object to them on account of their unreliability. This calls to mind a remark made by Professor Thurston at the Washington meeting of the American Society of Mechanical Engineers: "I think, gentlemen," said he, "that we may congratulate ourselves upon having settled the steel question, and that no engineer need henceforth hesitate for one moment to use American steel for boilers."

There is no doubt that a spirit of conservatism has something to do with the use of iron boilers by many here; or it may be that failures occurred when the steel here was not up to its present quality. But be the cause what it may, steel is nothing like so much used here as in the United States, nor do I think it is so good here.

As to engines, I shall have a good deal to say in the future upon those of French and English construction. Meantime I may say, however, that a great deal more attention is undoubtedly paid to the theoretical as well as practical perfection of construction of engines in the United States than appears to be the case either in France or England, and this statement also applies to the adjustment of the parts and the practical working of the engine. I am not referring particularly to the economy of engines as measured by the number of pounds of coal or combustible burned per horse power per hour, because the best results obtained in either country are, I believe, pretty nearly the same; and, besides this, it is exceedingly difficult to make comparisons, because the conditions are so rarely equal. Furthermore, it is no easy matter to separate the efficiency of the boiler from that of the engine. The indicator diagram has lost caste here as a guide to the consumption of steam of an engine, and rightly so, because it cannot account for the steam actually used by the engine. I mention this because of a remark made to me by an engineer yesterday to the effect that American engineers appear to attach undue importance to indicator diagrams, inasmuch as that the consumption of water and coal, and the friction of the engine, are often in America, he said, given upon deductions derived from diagrams. "A diagram," I am using his words, "will tell you a good deal about the disposition of the steam in a cylinder, but, in my opinion, not very much more, at high engine speeds, than can be known without it. For example, we are certainly independent of the indicator diagram in determining the width of port necessary for a given engine running at a given speed. We are certainly independent of the indicator diagram if we wish to know whether the steam is wire-drawn or not by the valve gear, or whether the valve or the piston leaks, etc., because we can determine these things without it. On the other hand, diagrams generally show the latter part of the expansion curve to be too high, which *may* occur from re-evaporation; but it may also occur from a leaky valve, or it may be that a leaky valve may leak enough to just equal the leak of a leaky piston, and the diagram will be all right in spite of both defects. Bah! The diagram will only tell us that we have made blunders that we never ought to have made."

This was his finale, and there is something in it; but there is something else in it, too, that he and a good many overlook. For example, a loop at the end of the compression line tells us a story that nothing but the diagram will tell, and, what is far more important, the diagram gives a plain, permanent record that is in many cases invaluable. The fact is that there are conditions in the United States that do not exist here, and there is also a call for mechanical refinement in the United States that does not exist here, and that it is hard to make people understand.

An excellent example is given in the engines for buildings. The first thing that strikes an American in a European elevator is its sluggish motion and the next is its jerkiness, and if you go down into the engine room you will find a noisy engine, even at a slow piston speed. Now, it is well known that an engine may run quite quiet at a slow piston speed that would be a complete nuisance at a high speed, and, furthermore, that an engine that would run gently enough for a four story building would be unbearable in the upper stories of an eight or nine story building; and when I told my friend of the refinement required in engines running in most of the tall buildings in New York, he did not seem able to comprehend it. I remember the case of a building in Nassau Street, New York City, the engine being under the sidewalk, and down there the engine seemed to run as quiet as could be desired, but in the top floors there was a disagreeable thud and vibration. That was the cause of several kinds of engines being tried. The fact was that the building acted as a sort of tuning fork, multiplying the vibrations as the length or height increased, and no engine that I have so far seen in England or France would have been at all bearable in the fifth story of that building if the engine ran at American speeds. Of course, in such a case as this, a great deal depends upon the adjustment of the amount of compression and lead, and this is just where the indicator steps in as an invaluable recorder, because it takes in the element of time, etc., and if the boiler pressure is kept fairly constant, an adjustment of the lead and compression may be made that will meet the requirements of each particular case or condition.

While on this subject of engines, let me say that the Porter-Allen engine, exhibited here at the last Paris exhibition, has left a record for quiet running that is not likely to be forgotten in Europe, for it ran at a piston speed of over 1,000 feet per minute, and that without the sign of a pound or thump, and that is almost unheard of here, even at a piston speed of 500 feet per minute.

Now a few words on engine adjustment. I was talking a day or so ago with the engineer of the Yarrow Engineering Co., whose reputation in torpedo boat building is too well known to require mention, and he said that theorists paid no more attention to perfect adjustments of valve setting and the amount of lead than they found necessary in their practice, and that they sometimes got the best results from engines whose valve motions were quite imperfectly set. He also said that the exact adjustment of lead they found of comparatively slight importance, notwithstanding that their piston speeds are 1,100 feet per minute, but then the requirement of perfect quiet running does not exist on board ship, and, to cut this matter short, nowhere do I find such perfect workmanship and engine adjustment demanded as in American stationary engine practice.

Mr. Bailley Blanchard (American commissioner to the exhibition), to whom I am indebted for courtesies, informs me that up to this date he has received advices of the arrival of about 800 exhibits from the United States, and among those already in the machinery department are the following: Singer Manufacturing Company, Newburg, N. Y.; National Cordage Company, New York; Chadburn & Coldwell Manufacturing Company, Newburg, N. Y.; Detroit Car Wheel Company, Detroit, Mich.; T. A. Edison, Orange, N. J.; H. G. Shepard & Son, New Haven Conn.; Brown & Sharpe, Providence, R. I.

The Chemin de Fer du Nord are to have an important exhibit of improved machine tools of novel design which I have seen, but am requested not to describe at present. I may say, however, that if the works of this railroad are fair examples of French locomotive works, the French have nothing to learn from either England or the United States in this matter at least. I shall, however, have something to say on this matter hereafter. Meantime, however, I would suggest that the American engineering societies who are about to visit the exhibition in May next ought to make an earnest endeavor to visit the above company's works at Lille, especially as it lies between Paris and Calais, and need not prolong the journey much, while there is some very interesting machinery there, not, perhaps, new in principle, but good adaptations of American and other systems, the point being that in the adaptation of some of what may be termed the more modern class of machine tools, such as milling machines and emery grinding machinery, the French, so far as I have seen at present, are ahead of all others, if these works are a fair sample. J. R.

Electrical Engineering at Princeton.

The course of electricity at the J. C. Green School of Science of Princeton College has always been an important and well equipped course, owing partly, perhaps, to the fact that it was at Princeton that the late Prof. Henry conducted his early researches in electrical science, and the apparatus that he constructed for his experiments may now be seen at Princeton. The impulse that he gave to these studies has not been lost, and the importance of sustaining the reputation of the college and of maintaining a high standard of work in this field has always been felt. Electricity, however, has come into such ordinary, every-day use that knowledge of it, practically and theoretically, is considered indispensable in a liberal education, and to that end a department of electrical science is shortly to be instituted. Proper endowment has been provided, and with Prof. Brackett at its head this school will afford unparalleled facilities for electrical research. This will be carried out within the current year, and a new building is to be erected for this department of electrical engineering.

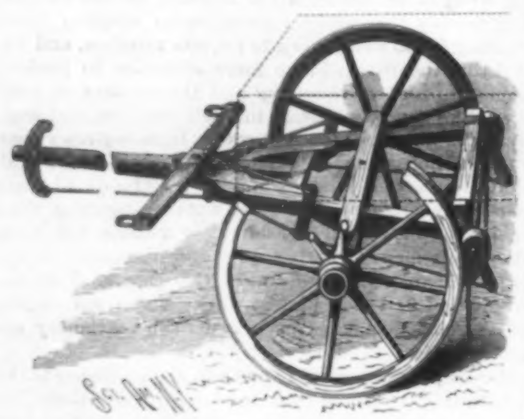
THE oscillation of high structures in storm winds is a much observed fact, and has probably been the cause of many failures in high chimneys by collapse or permanent set out of plumb by excessive pressure from the rocking motion set up in gales of wind. Tall church steeples built of stone are known to have a nerve disturbing motion with persons who have a curiosity to venture high up in them during high winds. Chimneys partake of this motion in a degree proportionate to the stability of their design, and in the proportion of diameter to height.

Observations of the movement of a chimney near Marseilles, France, 115 foot in height and only 4 feet outside diameter at the top, showed a maximum oscillation of 20 inches during a severe gale. Another chimney near Vienna, Austria, 164 feet high, of good proportions, having a 6 ½ feet flue, was found to oscillate 6¼ inches during the severest storms.

The Eiffel tower will no doubt be affected to a marked degree by high winds. Although its form of structure is of the least area to the force of the wind, its form and elastic material favor large oscillation in storm winds.

AN IMPROVED VEHICLE BRAKE.

A brake capable of automatic application, and which is designed to not only lock the wheels when the vehicle is descending a hill, but to lock them when the vehicle is stopped in ascending a hill, is illustrated herewith, and has been patented by Mr. John Fraser.



FRASER'S VEHICLE BRAKE.

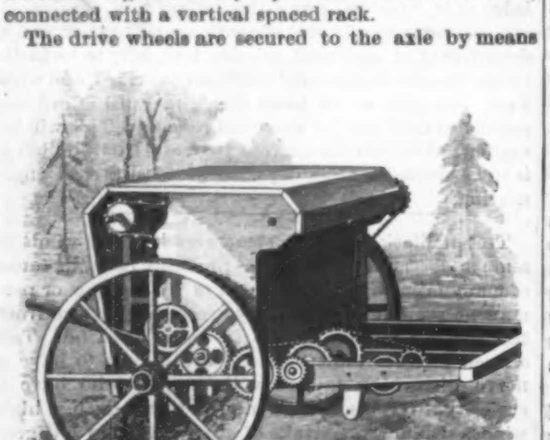
A clevis is secured to the forward end of the tongue, and a vertical yoke, with eyes at its ends, is pivoted thereon below the tongue. Forward of the axle a lever is vertically pivoted to the outer side of each section of the forward hounds, and the lower end of this lever is connected by rods or links with a rod passing through an eye and extending on the under side of the tongue to a pivotal connection with the vertical yoke on the forward end of the tongue. The tongue has a slot in which the bolt carrying the doubletree is held, two lengths of chain from a central staple on the doubletree being attached to links or rods which are connected to the upper ends of the levers vertically pivoted on the outer side of the hounds. A brake arm is pivoted to each extremity of the cross bar connecting the back ends of the hounds, and a brake shaft held by the arms carries on each end a brake shoe, having a concave and an opposing convex face, the brake shaft passing through the shoes near their larger end. A jack chain is attached to the lower pointed end of the brake shoe. In operation, when the horses hold back, and draw upon the upper end of the yoke on the forward end of the tongue, the brake beams are drawn forward, and their shoes come into frictional contact with the wheels, while as the horses start forward the doubletrees are also moved forward and the levers connected therewith carry the brake arms outward, relieving the wheels from contact with the brake shoes. To block the wheels in going up a hill, the jack chain is hooked in the stake ordinarily attached to the bolster of the vehicle, when the driver can, with a slight pull, bring the shoes in firm contact with the wheels.

For further particulars with reference to this invention address Mr. G. A. Upper, Simcoe, Ontario, Canada.

AN IMPROVED FERTILIZER DISTRIBUTER.

The illustration herewith represents a machine for distributing commercial fertilizers and sowing grain broadcast. It has been patented by Mr. Charles Greaves, of the Society of Shakers, Mount Lebanon, N. Y. The hopper is divided into a series of compartments by transverse partitions, each of the compartments having a vertically adjustable bottom or follower, connected with a vertical spaced rack.

The drive wheels are secured to the axle by means



GREAVES' "SHAKER" FERTILIZER DISTRIBUTER.

of a clutch, one section of which is integral with the inner face of the wheel hub, while its opposing section is made fast to the axle, the sections engaging each other as the machine is drawn forward and passing one another freely when the machine is backed. The racks of the followers are guided by a notched bar attached to the frame in advance of the axle, and in advance of the racks is journaled a shaft upon which are pinions adapted to mesh with the racks. The cover of the hopper has at its front and rear parallel shafts carrying near each end a sprocket wheel, the wheels being connected by endless chain belts, and these belts being united by strips of wood, so that as the belt is operated the strips pass directly over the top of the hopper, motion being communicated by means of a sprocket pinion and chain belt from a shaft journaled in the frame in advance of the hopper. There are also shafts journaled in the frame, in advance of the hopper, with suitable gears and pinions, by which the followers in the several compartments of the hopper are elevated, as the machine moves forward, at such rate of speed as desired, pressing the fertilizer or grain up against the strips of wood upon the endless belt, which is rapidly revolving at the top, the machine being adjustable so that it may be made to distribute fifty or one hundred and so on up to one thousand pounds of fertilizer, or a proportionate amount of seed, to the acre. When it is not desired to operate the hopper, the pinion shaft operating the racks of the followers is thrown out of gear by means of the lever at one side.

AN IMPROVED DRAUGHT EQUALIZER.

A device especially adapted for attachment to the tongues of harvesters, in connection with which three or more horses may be employed, is illustrated herewith, and has been patented by Mr. Jonas P. McDowell, of Foote, Iowa. A triangular iron is bolted on the left hand side of the inner end of the tongue, the iron having different apertures in its forward or straight member. In advance of this iron a horizontal arm is pivoted on the right hand side of the tongue, and upon the outer end of this arm an evener is centrally pivoted. A connecting rod unites the evener and its

McDOWELL'S DRAUGHT EQUALIZER.

supporting arm with the triangular iron, the adjustment of the connecting rod with either one of the apertures in the iron being made according to the strength of the animals on either the right or left of the tongue. At each end of the evener, upon its upper side, a doubletree is pivoted, preferably by means of a clevis or clip, whereby the entire draught is received upon the connecting rod and the triangular iron. To the rear of the evener, when parallel with the supporting arm, a stop block or bracket is vertically secured to the tongue, adapted to limit the rearward movement of the left extremity of the evener, and prevent the doubletree at that end from interfering with the binder. The stop also serves to hold the evener at a right angle with the tongue when turning corners.

Cedrus Deodora.

This is the great cedar of the Himalayas, and, under cultivation, is the most gracefully beautiful of all conifers.

A well grown specimen is sure to inspire in one a rare feeling of adoration. *Cedrus deodora* in its native habitat often grows to a height of several hundred feet, but under cultivation it has not as yet reached any great height.

In California, as in the Southern States, it is perfectly at home, and though slow in growth for the first few years, is beautiful in all stages, and no grounds are complete without at least one specimen. There is a notably fine tree upon the grounds of O. W. Childs in Los Angeles. Pasadena and Oakland also boast of handsome specimens.

In symmetry the tree is perfect, the branches are broad at the base, and reclining on the ground, then taper gradually to a sharp drooping apex. The thickset, tasseled branches give a soft, billowy effect, and the light silvery-green foliage forms a striking contrast to surrounding trees or plants. *Cedrus deodora*, like *S. verticillata*, the Japanese umbrella pine, should be planted much more generally, for such natural beauty is beyond moneyed value, yet is within the reach of every one who has a strip of ground.—*Cal. Florist.*

AN IMPROVED SNOW SHOVEL AND SCRAPER.

A combined snow shovel and scraper, designed to be readily changed from a shovel to a scraper, and *vice versa*, is shown herewith, and has been patented by Mrs. Lydia Fairweather, of Richmond Hill, L. I., N.

FAIRWEATHER'S SNOW SHOVEL AND SCRAPER.

Y. Fig. 1 shows the tool in form for use as a shovel, and Fig. 2 as a scraper, Fig. 3 being a bottom plan view of the shovel, and Fig. 4 an end view of the scraper. The handle is pivoted to the bottom of the scoop near its middle, and has a longitudinal slot in which is held a key adapted to pass on to the handle and the bottom of the scoop, as shown in Figs. 2, 3, and 5, to lock the scoop in place in either position on the handle, this key being held in place by pins or locked by a latch. To change the tool from a shovel to a scraper, the latch holding the key is unlocked, and the key disengaged from the bottom, which is then turned on its pivots on the handle so that the front end of the bottom extends rearward under the handle, as shown in Fig. 2. The key is then made to engage the bottom in this position on the handle, and is locked in place, the scraper, which had before been on the top at the rear, now extending downward on the front end of the bottom. On the outer edge of the endpiece is a transversely extending metallic plate, forming a scraper for loosening or removing snow or ice when this end is turned down.

AN IMPROVED FOOT BOARD FOR WOOD CHOPPERS.

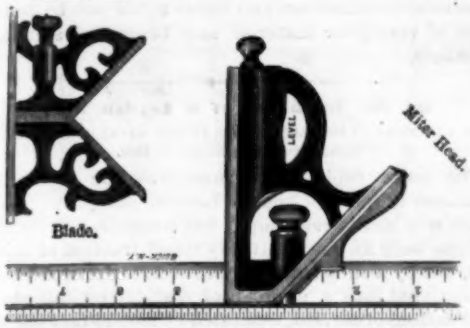
In felling large, heavy trees, where it is necessary to cut them considerably above the roots, to get rid of the heavy end, which would sink the butt too much in the water when the tree is made into a raft, and in other cases, a foot board is sometimes used for the chopper to stand upon and make a higher cut. The illustration herewith represents a device to facilitate such work which has been patented by Mr. Aaron L. Stevens, of Little Falls, Washington Territory. The foot board has an arm, beveled at its front end, to pass into a notch in the tree, as shown in Fig. 1, and on the inner end of the arm are upwardly projecting points adapted to engage with the tree. The outer end of this arm is provided with two arms, one above the other, between which is pivoted a tongue, having at its outer end a socket into which fits one end of a board of suitable width and length for the operator to stand on when chopping the tree. Fig. 2 is a plan view of the device, Figs. 3 and 4

STEVENS' FOOT BOARD FOR WOOD CHOPPERS.

being plan views of the arms and the pivot head of the board, respectively, these having roughened surfaces and notches, whereby the head is conveniently held in any desired position on the arm. The board can be moved around, as indicated in dotted lines in Fig. 2, to promote the convenience of the wood chopper as his work proceeds.

CHAPLIN TRY AND CENTER SQUARE.

This square is constructed with an adjustable blade, which enables it to be used for many purposes. It consists of a miter head or stock provided with a spirit level, a T or center head, and a sliding steel blade, graduated on one side in eighths and thirty-seconds and on the other in sixteenths and sixty-fourths. Among its many uses may be mentioned a try square, a depth gauge or a mortise gauge, a center square, or as a draughtsman's T-square. The blade, when removed from the stock, forms a graduated steel rule and straight edge. This square is made by the Standard Tool Company, Athol, Mass.



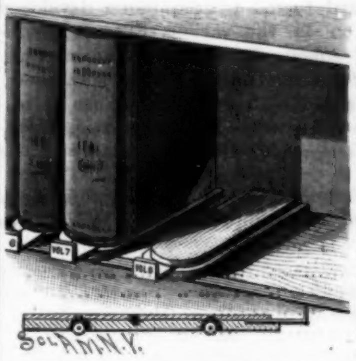
CHAPLIN TRY AND CENTER SQUARE.

A New Method of Illuminating Internal Organs.

The well-known experiment for showing total reflection of light in a jet of water or in a glass rod has been made use of here by Dr. Roth and Professor Reuss in devising a new method of illuminating from outside some cavities of the body, such as the larynx and nose. The instrument used for this purpose is a well-polished (not blackened) glass rod, to one end of which a small electric incandescent glow lamp, like those used for electric breastpins, is attached. The light of the lamp is reflected equally through the whole glass rod to its other end, which is placed on the skin of the throat in the case of a laryngoscopical examination being required. Then the interior of the larynx becomes illuminated sufficiently for laryngoscopy. If this luminous glass rod is applied to the sclerotic, the interior of the eyeball can be examined in the same way as by using an ophthalmoscope, the structure of the posterior parts of the vitreous body being very well seen and studied. As the glass rod remains cold, it can be employed in operative surgery to light the natural and artificial cavities.—*The Lancet.*

AN IMPROVED BOOK CARRIAGE.

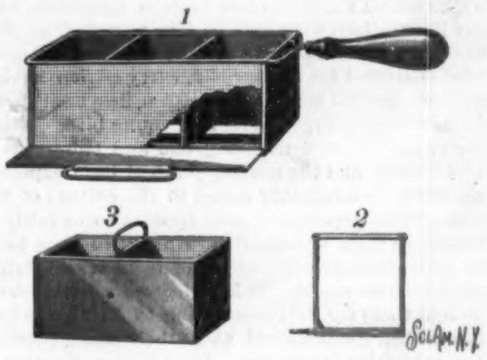
An invention to facilitate the drawing out of books from shelves or cases, and whereby the leaves and covers or binding will be protected from injury, has been patented by Mr. Lawrence C. Leith, of Galveston, Texas, and is illustrated herewith. The carriage is made of a size corresponding with that of the size of the book it is designed to carry, and has a raised central portion to support the bottom edges of the leaves, the lower edges of the cover or binding resting on a lower outer portion of the carriage. Inserted in the lower side of the book support are transverse rollers, whereby the platform is run in or out on the book shelf, there being provided at the front end a pull piece on which may be indicated the book or number of the volume the carriage is used to support and protect.



LEITH'S BOOK CARRIAGE AND PROTECTOR.

AN IMPROVED DEVICE FOR POACHING EGGS.

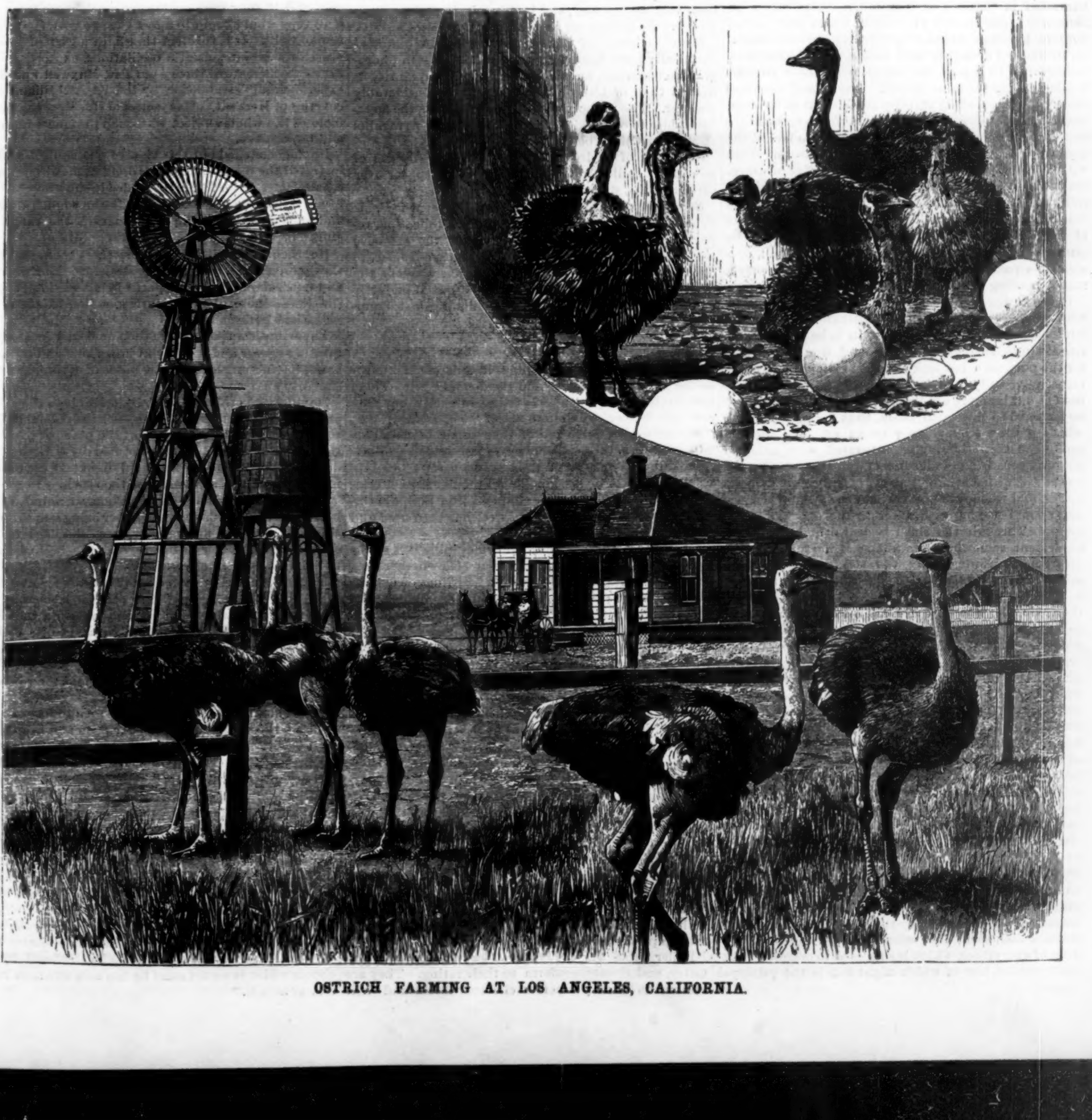
A simple device to facilitate the poaching of eggs, and placing them unbroken upon a platter, is shown herewith, and has been patented by Mr. William H. Littleton, of Clayton, Mich. The body of this egg-poacher is preferably made of sheet tin, and is divided by transverse partitions, one side being covered with perforations to freely admit the hot water. It has a sliding bottom, and the lower edge of the perforated side is provided with an inwardly projecting lip adapted to remove the egg from the bottom as the latter is drawn out. Fig. 3 shows a form of the poacher having a wire loop attached to the central partition for convenience in handling.



LITTLETON'S EGG POACHER.

OSTRICH FARMING IN CALIFORNIA.

Ostrich farming has proved so successful in South Africa that our Transatlantic cousins, always on the watch for some new means of developing the resources of their country, determined to try the same experiment in California, where the climate and surroundings were considered to be extremely fitted for the purpose.



OSTRICH FARMING AT LOS ANGELES, CALIFORNIA.

Accordingly, in 1882, some birds were imported from Cape Town, and in 1886 and 1887 further shipments were forwarded from Natal. This last was made by Mr. Cawston, who landed forty-two birds out of fifty-two. They were then taken to Mr. Cawston's "Norwalk Ostrich Farm," in Los Angeles, California, where our illustrations were taken. The voyage from Natal to Galveston, Texas, took seventy days, a ship having been chartered for the purpose, every ostrich having a separate padded box. Mr. Cawston has been successful in raising a large number of young birds—those in one of the illustrations being one and two weeks old. The climate and the country—as had been expected—appear to be admirably suited to the culture of these birds. The experiment also appears to be fairly profitable, as from one small bird and two hens he produced—principally by means of incubation—eighteen chicks in one season. Before they were ten weeks old he sold them for 87*l*., some going to Arizona, where a farm is being established, and others being purchased for exhibition purposes. In addition to this the feathers will realize 50*l*., making a total result of about 140*l*. from three birds. Ostrich feathers, we should mention, are protected in the United States by an import duty of 25 per cent, and, as the farm is close to large cities, good prices can be obtained for them.—*London Graphic.*

Japan.

The staple food of Japan is rice, and it is grown throughout the empire, not only wherever irrigation is possible, but the species known as upland rice is grown on high, dry ground, needing no irrigation, just as wheat is grown in America. In this consular district, Nagasaki, says John M. Birch, U. S. consul, the lowland variety of rice and the best rice in Japan is grown, and in such quantities that it is becoming a leading article of export. The fields in which it is grown in this district are small—the largest seldom being over one-fourth of an acre in area—and lie almost entirely under water from the time the seedling is planted in May or June until the ripened grain is harvested in October or November. The water so necessary is conducted to the fields, which have raised borders, by means of conduits from numerous streams, or, in times of drought, from basins, which have been constructed to retain the contents of these streams flooded during the rainy season. The sides of the numerous hills surrounding this city are laid out in terraces, and into the levels which are intended for rice, the water collected on the higher grounds is led by conduits, the quantity being regulated by means of dams provided with flood gates, so as to be let on or shut off at pleasure. On the level plains in the interior of the island of Keirshin, irrigation, however, is not so easy, the farmers being compelled to pump the water to the higher level of their fields from the streams or reservoirs. The pump in universal use resembles a water wheel, or a steamer's paddle wheel, and is made to revolve by a man ascending the float boards.

In the spring, about the month of March, the fields, which have been left without cultivation during the winter season, are dug up and begin to be prepared for rice sowing. In digging the ground the farmer uses for the purpose a mattock-shaped argricultural implement universally used in Japan. This implement is used as our laborers use the mattock, or the blade may be fastened to a wooden beam, thus forming a plow, which is drawn by a horse or an ox. The broken ground is then thoroughly saturated with a liquid manure, consisting of all sorts of refuse, such as night soil mixed with bathing water, rotten grass, bamboo leaves, and when dried by the sun the ground is again dug up and flooded with water to the depth of three inches. Through the slush is drawn an agricultural implement somewhat resembling a harrow, for the purpose of disintegrating the soil and thoroughly mixing the manure with it. The soil is now ready to receive the seedlings, which have been grown from the seed rice. The seed rice being soaked until ready to sprout is sown in very heavily manured patches of ground, covered with water during the night, and drained off during the day; and when the sprouts are six inches high, which is in the month of May, they are transplanted into the prepared fields as shallowly as possible (the number depending on the quality of the ground), in tufts of several plants, about six inches apart, and arranged in such a way that all the roots are of the same length. The work is done by all the members who are able to wade about in the water. The rice spouts thus planted require a great deal of manuring and cultivating before they put forth the ripened ear. It is estimated that from the planting time until the harvest, in November, the fields are hoed once every two weeks, in order that they may be kept free from weeds, water plants, etc. When the ear is about to burst forth the earth must be drawn up to the roots, and at the same time the plants must be heavily manured, which is done by the farmer pouring on the roots of each tuft liquid manure, consisting of a mixture of everything which is supposed to possess fertilizing qualities, but of which night soil is the principal ingredient.

In September the fields are permitted to become dry, and in October and November, when the ears present a yellow color, the grain is cut by an agricultural implement resembling a sickle, dried on the fields as our farmers cure the newly cut grain, made into bundles, and taken to the farmyards. The heads are then pulled from the straw by drawing the bundles through a comblike arrangement of wooden or iron teeth, hulled or thrashed by spreading them on a mat and beating them with a flail, and separated from the chaff by running the thrashed grain through a machine made of two bamboo baskets, placed one upon the other and full of cut bamboos placed on end, which form the cleaner. The food rice is also further cleaned by pounding it with a pestle, in a mortar-shaped vessel, and where a number of pestles are used in as many mortars, they are set in motion by water or steam power.

PHOTOGRAPHIC NOTES.

Improved Hydroquinone Developer.—Considerable discussion in regard to the hydroquinone developer has been going on in the various English photographic societies. Among the latest results made public is a developer recommended by Mr. Montefiore, which consists specially in omitting the use of sulphite of soda as a preservative and substituting therefor the comparatively new chemical meta-bisulphite of potash.

The formula as reported in the *Photographic News* is as follows, which is the proper strength to apply to the plate:

Hydroquinone	1	gr.
Meta-bisulphite of potash	2	"
Carbonate of potash	8	"
Hydrate of potash	2½	"
Water	1	oz.

Negatives may be fully developed with the above solution in five minutes. The solution was very cold. If too warm, it may soften the film too much, as the caustic potash is quite powerful.

Experiments we have made in preserving solutions of hydroquinone with meta-bisulphite of potash have been very satisfactory, and in using it in making positives for the lantern we have had much success.

Meta-bisulphite of potash may now be obtained chemically pure from American merchants in photographic materials, and as a much smaller quantity is needed than of bisulphite of soda, it is considerably cheaper. The proportions of two grains of the meta-bisulphite to one grain of hydroquinone or pyrogallol appear thus far to be the best.

Solutions of hydroquinone and meta-bisulphite of potash in distilled water, which we have kept for over three months, still remain colorless.

Substitute for Negative Varnish.—Says Mr. P. A. Schestakoff in a foreign photographic publication, reported in the *Photo. News*, simply flow the negative with common turpentine. It takes rather longer to dry than ordinary varnish and somewhat weakens the negative, but it takes the retoucher's pencil perfectly and at the same time protects the film against dampness.

Wrought Iron Water and Steam Pipes.

There are three classes of pipes in general use, known as the *common*, the *extra*, and the *double extra*. These terms refer to the thickness of the pipes only, but they are also known by the names of "*butt-welded*" and "*lap-welded*," descriptive of their mode of manufacture. Boiler tubes are always lap-welded. Butt-welded pipe is only made up to certain sizes, but lap-welded pipe can be procured of all regular sizes. Formerly pipes were made from charcoal iron skelps exclusively, but within a short time steel has been used and has given general satisfaction.

In procuring the fittings for iron piping it is necessary not only to state the size, but also whether they are to be of cast or malleable iron. Fittings of malleable iron have a neater appearance and are lighter than those of cast iron, but are very difficult to break, and it often happens, when making extensive repairs, that the time expended in taking off a fitting and saving it would more than amount to its value, and for this reason cast iron fittings, though somewhat clumsy in appearance and heavier, are often employed, as a few blows of a hammer will break them so that they can be removed without trouble.

Wrought iron pipe can now be procured from one-eighth of an inch to twenty-four inches in diameter, and it has been proposed to make them of even forty-two inches.

The usual length of pipe, as furnished from the mills, is sixteen feet, but greater lengths can be obtained to order at an increased price per foot.

The size by which a steam or water pipe is known is its supposed internal diameter—but this diameter, though about uniform among manufacturers, does not exactly conform to the size at which it is rated—being with common pipe a little in excess, and with double extra pipe somewhat less.

Boiler tubes are always rated by their external diameter, and closely conform to their rating. They are also made of very superior charcoal stock, and their ends are annealed. In ordering boiler tubes, their length as well as their diameter must be stated. Nothing need be said as to their thickness, as that is a constant for every diameter.

To the above the *Safety Valve* adds: In ordering pipe or boiler tubes, always deal with a firm of good repute, for there is plenty of pipe in the market of questionable character, and boiler tubes can be found both of very poor material and below the standard thickness.

On the Discharge of a Leyden Jar.

FROM A LECTURE BY DR. OLIVER LODGE AT THE ROYAL INSTITUTION, ON FRIDAY EVENING, MARCH 8, 1889.

The main topic of discourse was the oscillatory character of the well known Leyden jar spark. Each spark is in reality not simple, but complex, and though it lasts only an inconceivably small fraction of a second, yet by a sufficiently rapid revolving mirror it can be analyzed into a number of distinct oscillations or alternations of current, separated by momentary pauses, analogous to the vibrations of a loaded spring or the reed of a musical instrument. If the discharge be interrupted before it is complete, the jar can be found charged in a precisely opposite way to what it was at first. The fact is that the discharge has inertia and overshoots the mark, first in one direction, then in the other, precisely as happens with a swinging pendulum.

The original experimental discoverer of the fact of oscillation in a Leyden jar discharge was stated by the lecturer to be Joseph Henry, of Washington, in 1842. But the fact has been lost sight of, and it was Helmholtz, in 1847, who showed that oscillations were a necessary consequence of the conservation of energy; while in 1853 Sir Wm. Thomson gave the complete mathematical theory of the subject.

The oscillations have been seen, after considerable labor and careful experiments, by Feddersen in Germany; but they are ordinarily of extraordinary frequency. They are often more than a million per second, and usually more than a hundred thousand. They can be easily got as high as a hundred million per second, and if they were made very much more frequent still, they would begin to affect the eye with the sensation of light. It is this fact that light is excited by and consists of minute electric oscillations, as worked out in the mathematical theory of Clerk-Maxwell and now experimentally established by the recent brilliant discoveries of Herz—it is this fact, said the lecturer, which incloses the whole subject with such profound interest and importance.

Having sketched out this view of the subject and illustrated the mechanism of the oscillations by mechanical analogies, Prof. Lodge proceeded to show how he had found it possible to make the oscillations much slower, and ultimately to bring them within the range of audition.

He then proceeded to exhibit these comparatively slowly oscillating sparks to the audience, the whistling and musical sound of the sparks being most apparent, the lowest note obtained corresponding to about 500 vibrations per second.

These musical sparks were then analyzed in a slowly rotating mirror and spread out into a long and serrated band, having much the appearance of a singing flame similarly analyzed.

Having made this demonstration visible to the entire audience, the lecturer next proceeded to exhibit another recently discovered fact, viz., that the plane of polarization of light could be easily rotated by a Leyden jar discharge, and that the restored light was oscillatory in precisely the same manner as the spark.

A long tube of bisulphide of carbon, surrounded by a helix, was employed, and light, after being sent through this and through an analyzer, was submitted to the same rotating mirror as before, and the beaded band of light made distinctly visible.

These were the principal experiments; but other matters, such as sympathetic electric resonance, by which the discharge of one Leyden jar could be made to burst an air condenser properly timed to its oscillation period, were referred to, and also demonstrated in the library during the evening.

The lecture was concluded with the following peroration:

"An old and trite subject is thus seen to have, in the light of theory, an unexpected charm and brilliancy. So it is with a great number of old and familiar facts at the present time. The present is an era of astounding activity in physical science. Progress is a thing of months and weeks, almost of days. The long line of isolated ripples of past discovery seem blending into a mighty wave, on the crest of which one begins to discern some oncoming magnificent generalization. The suspense is becoming feverish; at times almost painful. One feels like a boy who has been long strumming on the silent keyboard of a deserted organ, into the chest of which an unseen power begins to blow a vivifying breath. Astonished, he now finds that the touch of a finger elicits a responsive note, and he hesitates, half delighted, half affrighted, least he be deafened by the chords which it would seem he can now summon forth almost at will."

THE ARTESIAN WELLS OF THE JAMES RIVER VALLEY, DAKOTA.

(Continued from first page.)

works and a pumping sewage system without cost of fuel, engineers, or even oil. The pressure of these wells is about 200 pounds per square inch. A two-foot vein of coal was struck in the first two wells.

Ellendale, north of Aberdeen thirty-seven miles, has a well 1,087 feet deep. Water was found in sand rock beneath an impervious stratum of shale. The water is clear and soft, with temperature of 67° and pressure of 150 pounds per square inch. The city has a system of water works costing less than $7,000.

The Redfield well is 960 feet deep. The tube in this well is of three sizes. The first 400 feet is 6 inches, the next 300 is 5⅝ inches, and the last 260 feet 4½ inches. Water was found in sand rock. Coal was found at different depths, and smelled of oil. The water is clear and soft, has temperature of 68° and pressure of 200 pounds per square inch. The city has a complete system of water works for fire, lawn, and house use. It takes four strong men to hold the hose.

The Huron well is 863 feet deep, having a 6 inch tube from top to bottom. Water was found in sand rock. The pressure is upward of 200 pounds per square inch. Water is a little hard, and most of the time clear. Temperature is 60°. Huron has two miles of water mains and two miles of side piping. Besides furnishing water for fire use, it runs motors for two laundries and four printing offices, using about 20 horse power. The Huron and Redfield wells are perhaps the best in the valley.

Yankton has two 6 inch wells, one 610 feet deep and one 600 feet deep. These wells furnish fire protection through 19,400 feet of pipes, and run the electric light, two printing presses, a tow mill, feed mill, and furniture factory. The water in these wells has a pressure of 56 pounds per square inch, and, unlike most of the other wells, is hard. It is, perhaps, the best drinking water of any of the wells in the valley. The second well did not diminish the flow of the first. Water was found in sand rock, temperature 62°.

The Jamestown well is 1,576 feet deep, and has a pressure of 100 pounds. Water is clear and soft, with temperature of 75°. At 300 feet quite a flow of gas was met. The city has a system of water works with the well.

The above wells are mentioned out of quite a number of equal value over a distance of 300 miles. These lie in about the center of the valley. A well at Andover, at the extreme east side of the valley, has a pressure of 100 pounds, while one at Ipswich, at the west side of the valley, has a pressure of 90 pounds. At Miller, 40 miles west of Huron, the pressure is 125 pounds. The greatest average pressure is in the center of the valley. The above figures will be at variance with the gauges as they are now found on the wells. The gauges are placed above the valve, where the pressure is greatly relieved by the overflow. The above figures, in most cases, give full pressure.

Noted wells in other parts of the world fall far below these. The well at Belle Plain, Iowa, which got beyond control and created such a scare, had only a fraction of the power of these wells. The Belle Plain well had a pressure of only about 25 pounds per square inch, and this lessened in a few days. Water was struck at only 86 feet, and the soil above it disintegrated so easily that a hole as large as a wagon wheel was made, out of which a large quantity of water flowed, and threatened for a time disaster to the city.

The great well in the Place Hebert, Paris, France, is 2,359 feet deep and has a diameter of 3½ feet, yet it does not throw much over 1,000 gallons per minute, while many wells in the James Valley throw 3,000 gallons per minute.

The possibilities of the wells in this valley are beyond estimation. With millions of gallons flowing daily, there has been no diminution of the supply. Nature stores the supply, and it only awaits tapping and application. If one of the wells at Yankton, with a pressure of only 56 pounds, has taken the place of a 30 horse power engine, what can be done with a well with 200 pounds pressure? Then if larger bores were made, any amount of pressure desired could be obtained. Large bores should be made, because to get a certain amount of flow the valves have to be opened so wide that the water rushes out with such speed as to cause pieces of the sand rock to fly out of the well. This difficulty was met with to such an extent at Aberdeen that they were compelled to place a stone-arresting drum at the well.

That such an ideal power has not been utilized to a greater extent can only be accounted for by the fact that the country is so new. Gas was found in many of the wells. At Ashton, the cooking in a hotel is done by natural gas. If the proper system were employed, a good supply of gas might be had.

The query arises, Whence the source of all this water? Some believe it comes from the Missouri River. This cannot be true, because at Highmore, 40 miles west of Huron, there is a well with 25 pounds pressure, and the elevation is several hundred feet above the river. At Gettysburg, only 16 miles east of the river, they have drilled 1,300 feet without getting a flow. Drillings east of the valley (in Dakota) have been unsuccessful, striking almost invariably at a few hundred feet, without getting water, the Archæan rock, which is usually the bed of artesian water. The large lakes north have a less elevation. The theory is advanced that the flow is caused by the pressure of the earth or gas upon a subterranean basin. This theory is decidedly gaseous. This would imply a hermetically inclosed space, which would soon exhaust. No such basin has been found in any of the borings. Water is found in soft sand rock, being confined above by impervious shale. Small channels, sometimes, however, connecting with open water, may exist, as is indicated by numbers of small fish with eyes that have come out of two of the Aberdeen wells. Accepting, as we must, that water finds its level, and that it rises no higher unless acted upon by some external force, we must look to some place where the elevation and quantity are sufficient to supply these wells. These wells are undoubtedly fed from the Rocky Mountains.

Great care is required in putting down these wells where the pressure is so great. If any accident happens to the tubing after the full flow is met, it is almost impossible to overcome it. Nature has furnished no valves which may be closed while the well may be repaired. The wells at Frankfort and Groton are serious failures. Both of these have thrown muddy water most of the time since they were put down. The Groton well has covered acres of land with its mud, and, at one time, broke out in different parts of the town. Some break or disconnection has occurred above the impervious strata, and the dire consequences are hard to estimate. An inch tube by way of experiment was put down in the Frankfort well about 650 feet. It came out minus 130 feet, with the point scraped on one side and bent, which indicates that it got outside of the well down about 520 feet. It also indicates a space minus earth, as that 130 feet passed down outside of the well without meeting any resistance. The tube was put down by hand. That basin was not there when the well was put down.

It will be noticed that in some of the above tubings the iron is only 3-16 of an inch in thickness. This is too little to resist the enormous pressure at the bottom of a well of 1,000 feet depth, having a pressure of 200 pounds per square inch at the surface. Water exerts a pressure of about 43 pounds per square inch for each hundred feet in height. This would give such a well at the bottom a pressure, when the valve is closed at the top, of 630 pounds per square inch—a pressure nearly four times greater than a locomotive carries with a boiler twice as thick. A wisp of straw accidentally carried down 2,000 feet in the Place Hebert well was returned so compressed that it dropped in water like lead. Ordinarily the walls of the earth resist the pressure upon the pipes, but should a piece chip off, the pipe might burst at this point. Then if there were no impervious stratum above the break, the result might be like the two above mentioned wells.

Sometimes it is impossible to force a pipe down more than a few hundred feet. In this event a smaller tube is put down inside of the first. Sometimes as many as three sizes are put down. When the inside pipe is down far enough, there is no further use for the outside pipes. These cannot be easily drawn out, owing to the friction against the walls of the earth, so an ingenious method is employed of using a left hand thread at the proper depth, enabling them to take out the top parts of the inside pipes instead. This leaves a well of telescope appearance, with small end down. The inside pipes do not necessarily, when put down, fit the outside pipes water-tight, but when separated a swedging process is used, which makes them water-tight. If this is not thoroughly done, the water will escape, making the flow muddy, and if, as before mentioned, there is no impervious stratum above, the water will break out about the well.

The following analysis of the Jamestown water is perhaps an index to that of most of the water:

ANALYSIS OF ARTESIAN WATERS IN DAKOTA.

Jamestown—organic matter: free ammonia, 2·4 parts per million; albuminoid ammonia, 0·046 part per million; nitrites, traces; nitrates, none.

INORGANIC MATTER.

Silica	35·70	2·0823
Alumina	3·50	0·2041
Carbonate of iron	2·20	0·1233
Carbonate of lime	188·00	10·7643
Sulphate of lime	249·00	14·5243
Sulphate of magnesia	154·20	8·9944
Sulphate of soda	1139·40	66·3602
Chloride of sodium	369·10	21·5296
Sulphate of potash	31·05	4·7596
Phosphates		a trace
Hardness		21°

The engravings are accurate representations of the enormous heights to which the water is thrown by natural pressure.

THE chemical journals announce as newly discovered solvents of Prussian blue, molybdic acid, which dissolves it in large quantity, and molybdate and tungstate of ammonia, which also dissolve it very readily.

Correspondence.

Occultation of Jupiter.

To the Editor of the Scientific American:

The occultation of Jupiter by the moon yesterday morning was very successfully observed here with the 10½ inch equatorial refractor. The sky was very clear indeed. The first contact was noted at 18 h. 45 m. 47 s. sidereal mean time. The last contact at emersion was recorded at 19 h. 37 m. 31 s. My daughter Anna (eleven years of age), who observed the phenomenon with the three inch finder attached to the large telescope, independently recorded the first contact one second earlier than above.

Jupiter was distinctly seen, although the sun was shining brightly, and the belts of the planet were easily visible in both telescopes.

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., March 25, 1889.

English War Ships.

There is, says the London *Engineer*, a vague sense of something lacking which is not pleasant, and it seems strange that notwithstanding the enormous variety in type admissible in the navy, nothing has been produced which is perfect in one respect. Thus we have nothing superlatively fast, or steady, or safe from being sunk, or able to fight her guns to perfection. Compromise is no doubt an excellent thing, but it is possible perhaps to push it too far, and it seems as though it might be worth while to abandon some qualities wholly to secure the possession of others in perfection. Thus, for example, it might be worth while to arm ships of the Archer class with guns which they could really use at sea; and although something else would have to be sacrificed, it might be found better in the end to raise the turret guns of the Hero, which are now, we are told, so close to the deck that the explosion from them is likely seriously to damage the upper deck fittings in their line of fire. As it is now, all the fittings on the fore deck leak badly, and the mess deck is always afloat when steaming against a moderate sea. A trial of the strength of these fittings should be made by firing full charges right ahead. The great defect of the modern British navy is that we have always tried to combine too much in one ship. Our designers have behaved in effect like men who have to pack into one portmanteau what would fill three; they are reluctant to leave out anything, and the result is that the whole is crushed and spoiled. A very large sum is to be spent on the navy. Let us hope that, instead of building half a dozen ships, in each of which half a dozen more or less incompatible qualifications are to be combined somehow, the plan will for once be tried of building half a dozen different ships in each of which will be found some superlatively good qualities.

Deoxidized Bronze.

A representative of the *Iron Age* paid a visit recently to the foundry of the Deoxidized Metal Company, of Bridgeport, Conn., of which L. H. Bacon is president, O. C. Smith is secretary and treasurer, and W. W. Keys is superintendent. The works are equipped with 23 crucible melting holes, which are to be supplemented in the near future with a large reverberatory furnace, to be heated with oil, capable of melting 10,000 pound charges. The foundry is to be enlarged by the addition of a building on adjoining property recently acquired, which is to be 80×130 feet, and is to be used chiefly for heavy loam work. Until now the largest castings of deoxidized bronze made were the rings of digesters for the bisulphite wood pulp process, which weighed 8,500 ppunds. Five rings and top and bottom casting composed such a digester, 22 feet long, 7 feet 8½ inches in diameter, and weighed 28,000 pounds. Soon larger digesters are to be made, weighing 45,000 pounds, the company having orders for 19 of these large and 17 small digesters. Tests made in 1886 by Dr. T. M. Drown, of the Massachusetts Institute of Technology, proved the resistance of the metal to the corrosive action of bisulphite of lime.

The Late Professor Proctor.

From a letter that has come into our hands, from the widow of the late Richard A. Proctor, it appears that the astronomer did not die of yellow fever, as has been commonly supposed, but of a low remittent malarial fever, that his wife and two of his children likewise suffered from. His son died of the same disease last November. Mrs. Proctor is desirous of making journalism a profession. As secretary and assistant editor of her husband in his literary work, she has had considerable experience, and has besides an aptitude and fondness for this class of work.

Mrs. Proctor has recently received a civil list pension of $500 as the result of a memorial signed by Sir John Lubbock, the Duke of Argyle, and other prominent countrymen of the deceased. Mrs. Proctor is at present residing at her home at Corona Lodge, Orange Lake, Florida.

JOHN H. B. LATROBE.

Born May 4, 1803, Mr. Latrobe, of whom our engraving presents an excellent likeness, is still an exemplar of physical and intellectual vigor in competition with whom many men half a hundred years younger would decline to enter the lists. He has been from the first, and is now, counsel of the Baltimore & Ohio Railroad, and rode on the first locomotive tested on the line, in 1830; he aided in promoting the first telegraph line built by Morse, between Baltimore and Washington; and has been actively engaged, thoughout his long life, in the most exacting labors, partaking somewhat of an engineering as well as of a legal character.

Mr. Latrobe was entered as a cadet at West Point in 1818, but, owing to his father's death two years later, was obliged to resign before the completion of his course, although he was then at the head of his class, and would in a few months, according to Gen. Thayer, have received "the highest honor and prize for distinguished scholarship and merit." He then entered a law office in Baltimore, and was admitted to the bar in 1825. At first he eked out the means afforded by a limited practice by various literary labors, among which were some school books, with a work on "Infantry and Rifle Tactics," and he then began "Latrobe's Justices' Practice," which superseded previous works on the subject in Maryland, and later editions of which are still an authority.

In 1828, Mr. Latrobe was employed by the Baltimore & Ohio Railroad Company, his first work being the obtaining of rights of way on the Potomac River, and it was here, in 1830, that he assisted at the trial of Peter Cooper's locomotive, the Tom Thumb. The road was at first built with short curves, around which it was impracticable to run locomotives then built in England, but Peter Cooper built an experimental engine for the purpose, which proved entirely practicable in principle.

In 1843, after Congress had appropriated $30,000 to enable Morse to test his telegraph, the inventor applied to Mr. McLane, president of the Baltimore & Ohio, for permission to establish a wire upon the line of the road. Mr. McLane did not approve of the project, which he deemed chimerical, and referred the inventor to Mr. Latrobe. The latter became thoroughly imbued with the inventor's enthusiasm, and reported to President McLean that "numerous and exalted as had been the positions he had held, his name would be forgotten, while that of Morse would be echoed throughout the ages." Mr. Latrobe has lived to see the sure promise of the fulfillment of his prophecy.

Soon after the organization of the Franklin Institute in Philadelphia, Mr. Latrobe undertook to get up a similar institution in Baltimore, the attempt resulting in the founding of the Maryland Institute for the Promotion of the Mechanic Arts. In 1853 he was elected president of the American Colonization Society, a cause in which he was for many years zealous and untiring; subsequently being connected with the International Association for the Exploration of Africa, organized by the King of the Belgians. His general law practice has always been large, and he has also been actively engaged in the patent law branch of the profession. He was also the patentee himself of an invention which has become noted, the well known "Baltimore heater," known throughout a large section only as the "Latrobe stove."

Mr. Latrobe, in 1857-58, was the counsel of Messrs. Winans, Harrison & Winans, spending the winter in St. Petersburg in looking after the interests of his clients in their great contracts with the Russian government, and in 1868 published a volume entitled "Hints for Six Months in Europe." He was commissioner from Maryland at the Centennial exhibition, and at its close received the thanks of the "Society for the Better Observance of the Sabbath" for the part he had taken in closing the exhibition on Sunday. He was one of the founders of the Maryland Historical Society, of which he is the president, and as one of the Regents of the University of Maryland has been very active in bringing its Law School to its present prosperous condition. He was chairman of the Public Park Commission, and has, since its organization, borne a prominent part in its work. While the Maryland Academy of Art was in existence, and until its collections were transferred to the Peabody Institute, he was its president, and he was one of the original purchasers of the Greenmount estate for the establishment of the present cemetery, and has for many years been the president of the Proprietors. He is the elder brother of the distinguished engineer, the late Benjamin H. Latrobe, who was educated a lawyer and became an engineer, while the subject of our sketch was educated an engineer and became a lawyer.

Mr. Latrobe has never taken any active part in politics, but in all projects for promoting the industrial good and social advancement of Baltimore and of Maryland, in the originating and carrying into execution of enterprises of great value to the present and future, he has ever been one of the foremost citizens of that commonwealth.

Mr. Latrobe has several children, among them F. C. Latrobe, mayor of Baltimore, who is now occupying that office for the fifth term.

JOHN H. B. LATROBE.

Funeral Cars.

The Brill Car Works, of Philadelphia, have just finished three street cars, designed to transport the dead in Buenos Ayres. The cars are unique in construction and are the first of the kind made in this country. They are first, second, and third class, the first being designed to carry the body of a wealthy individual, the last the corpse of a pauper.

The first class car is very handsome. The body is a rich black toned with purple, with passion flowers painted on the sides. The windows are of French plate glass. The seats, folding up against the sides, are upholstered in black plush, and the window curtains are of black cloth trimmed with gold bullion. In the forward end of the car is an altar, with silver cross and candelabra, while on either side the altar are cathedral purple stained glass windows. The interior of the car is finished in white and gold. The metal work is nickel plated and handsome in design. On the top nine large sable plumes are placed. The other cars are much simpler and plainer in design, and the third class car has merely a row of shelves for the coffins.

These cars are intended to run on the street car tracks in Buenos Ayres, and will be switched off on a side track nearest the house of the dead person. The body is carried on a bier to the car, placed inside, the mourners seat themselves around, horses are attached and the car proceeds on its way to the cemetery. This custom is adopted in the city of Mexico and in some cities of Central America. The only parallel among northern nations is the dead train which leaves the Gard du Nord in Paris at 5 o'clock every morning, carrying the bodies of paupers and unrecognized persons of the morgue.—*Philadelphia Times.*

Decision of the United States Circuit Court on Storage Battery Patents.—Both the Parties Satisfied.

Judge Cox, in the United States Circuit Court for the Southern District of New York, on March 19, 1889, handed down an opinion in the suit of the Electrical Accumulator Company vs. the Julien Electric Company.

The Julien people say the Court does not sustain any of the claims of the complainants. The Accumulator Company, on the other hand, say the decision fully sustains their patents.

Deep Gas Wells.

The question of deep drilling in gas wells, says the New Albany (Ind.) *Ledger*, in localities where the rock strata are deeply sunk, as they are at New Albany, has caused a good deal of interesting discussion in connection with the theory entertained by some that natural gas cannot be found below the sea level. This latter theory has certainly been disproved in many instances in this country, and it is almost universally disproved in the gas wells in Russia and China, nearly all of which are deep wells, far below sea level.

The Westinghouse well at Pittsburg is 4,618 feet deep, over 2,000 feet below sea level. The gas well at St. Catharines, Can., is 4,000 feet deep. The Presque Isle gas well developed a small flow of gas at over 4,000 feet, but at 4,300 feet the tools were lost in the well. The Trenton rock which always underlies the Hudson River rock in the Lower Silurian was not struck till the drill reached nearly 4,300 feet. The big gas strike at Kingsville, Ont., was made at a depth of 3,200 feet, and the company holds the well at $104,000, and will get that for it. At Thorold, Ont., the drill went down to 2,700 feet before gas was struck. At Fort Smith, Ark., where sea level is reached at about 600 feet, gas was struck at 2,700 feet, and the well developed a pressure of 250 pounds to the square inch. Near Harrisburg, Pa., are two gas wells, both of which are 3,000 feet deep. At McKeesport, Pa., there is a very productive well that is 2,500 feet deep. The gusher at Dowegiac, Mich., is 2,700 feet deep. The most successful well at Lucknow, Tenn., is 3,000 feet deep. The Zoar well, an immense gusher, in Cattaraugus County, N. Y., is 3,100 feet deep. When gas was struck in it at that depth, the volume was so great that the tools in the well, weighing 3,100 pounds, were thrown into the air 300 feet and the derrick utterly wrecked. There is a very strong and probably well founded probability that a well from 2,300 feet to 3,000 feet in depth at or in the vicinity of New Albany would reach the gas reservoir. It is certain that natural gas will not be found in quantity to be utilized in this part of Indiana until the Hudson River strata have been passed through by the drill. It is safe to say that every well drilled in this city or vicinity has been stopped in the Hudson River strata, where the drill pump was sending up flour-white accretions.

Be Prompt in Appointments.

The *Manufacturer's Gazette* thinks there is nothing more damaging to a business than to be found wanting in the matter of promptness in filling orders. A great many firms will promise to have an order at a certain time, when they are confident in their own minds that it will be almost an utter impossibility to do so. This is done to secure the orders, but cannot fail of a damaging effect in the future. It is just as important that an order be filled at the time agreed as that any other engagement or appointment be kept. The man who arranges for a meeting with another at a certain time is expected to be on time. In these days of great enterprise and push, every business man has his time fully taken, and promptness in keeping an appointment is an important matter to him. Just so it is in filling orders. Promptness is as much to the credit of a concern as is the quality of the work or the material used.

Cotton and Wool.

The crop of cotton is reported as being very large, possibly greater than that of any recent year. Yet the demand for the staple continues, and the size of the crop seems justified by the demand. The manufacture of cotton goods is now profitable, and new mills are in course of erection in all parts of America, and in this movement the South is conspicuous. Soon the raw material will be manufactured on the large scale near the place where it is grown, and the New England mills will be handicapped by their distance from the cotton fields, in the competition with their Southern rivals. The outlook for cotton is therefore a bright one. Wool, the other great textile staple, cannot be so well placed in the economic sense, owing to the great deficiency of reliable statistics. At a recent convention, the National Association of Wool Growers took steps for establishing a better system, including the organization of a central bureau of statistics. When this is carried out, the wool producer will be greatly benefited, not only by accurate statements and forecasts of the market, but by a better gradation of qualities. It is proposed to have this matter, the grading of wool, taken up by the Association. Few staples need grading more imperatively, as wool suited for one branch of manufacture may be quite unadapted to another; the carpet maker needs a material totally different from that required by the manufacturer of zephyr wrosted.

Inventions Give Employment to More than they Throw out.

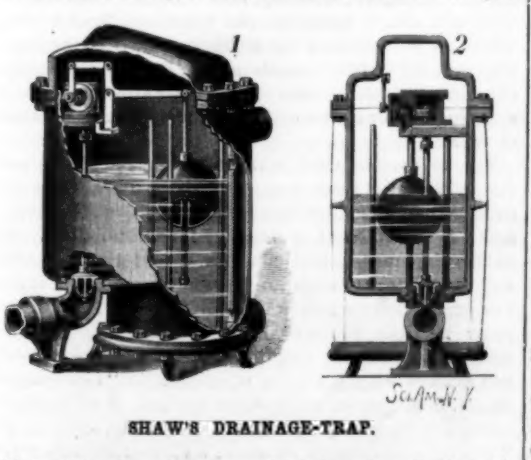
Frequently one sees appalling computations of the vast number of workmen who are constantly thrown out of employment by new mechanical inventions that take the place of human hands. But along with the displacement of hand labor there has gone a replacement, in consequence of the increased production that always follows a cheaper process of manufacture. Especially is this observable in all artistic matters. Pictures that are now produced and given away as advertisements could not be bought except by the well-to-do people a century ago. Art has been applied to a thousand articles of daily use, and artistic forms thus perpetuated have come to the homes even of the poor. Cheaper processes of engraving are now in use; but instead of causing the employment of fewer artists this requires the services of more and better artists, and they are paid now more than they ever were. A new class of artists have sprung into existence. They are known as pen and ink draughtsmen, and it is they who have made the illustrated newspapers of to-day far superior to those of even a quarter of a century ago. They command a salary of from $5,000 to $15,000 a year.

But it is not alone in picture making that the progress of invention gives new employment for artists. There is an immensely wide field for designers in wall papers, carpets, all sorts of textile fabrics, silverware, furniture, and hundreds of other departments. There are armies of artists engaged in making patterns and designs that were never needed in the world until new processes of duplication created an almost insatiable demand for variety.

Other fields of employment have also been opened in the present generation for vast numbers of workmen. In the construction of electrical apparatus, of watches, of machinery and tools, and the thousand and one products of invention, there is room for the laborer. There are more women employed even at sewing, and at better wages than ever for the skilled. The typewriting machine has already its army of wage earners. The discovery of crude oil has put legions at work, and, looking at the whole subject, it must be admitted that though mechanical inventions have put a great many persons out of work, they have also put a great many persons into work, besides producing for the multitude an endless variety of beautiful and useful as well as cheap products.—*Baldwin's Textile Designer.*

AN IMPROVED DRAINAGE-TRAP.

The accompanying illustration represents a drainage-trap for automatically discharging the water of condensation whenever a certain quantity has accumulated, Fig. 2 being a transverse sectional view. It has been patented by Mr. John Shaw, Sr., of Bayonne, N. J. In one side of the casing is a channel connected at its upper end with an inlet pipe leading to the steam supply, this channel being connected with the interior of the casing by apertures near the top and bottom, and there being opposite the bottom aperture a blow-off pipe with suitable valve, by means of which the casing may be cleaned of sediment. A short distance above the bottom of the casing is an offset, in which opens a water outlet pipe having a valve opening inward, the valve being on the lower end of a piston rod moving vertically in a cylinder supported on a bracket in the upper part of the casing. On this cylinder is formed a valve chest, the valve opening and closing ports leading to the top and bottom of the cylinder, and also controlling an outlet port through the bracket. The valve stem carries an arm pivotally connected by a link with the short arm of a bell-crank lever fulcrumed on the bracket, and pivotally connected with a rod pro-

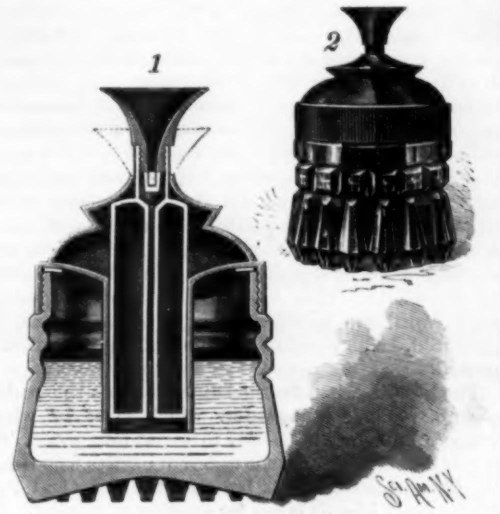


SHAW'S DRAINAGE-TRAP.

vided with collars between which travels a float, guided in vertical guide rods. As steam passes to the interior of the casing, the water of condensation finally closes the bottom opening from the side channel, and the float rises until it presses against the top collar on the vertical rod. As this rod is moved upward by the further accumulation of water, the bell-crank lever is turned to operate the valve and admit steam into the bottom of the cylinder, lifting the piston and opening the valve in the water outlet pipe. The sinking of the float as the water goes out, pushing on the lower collar of the vertical rod, swings the bell-crank lever to uncover the upper inlet port of the valve, whereby steam is admitted to the top of the cylinder, forcing the piston downward and again seating the valve in the water outlet pipe. The valve seat of the water outlet pipe is located somewhat above the bottom of the casing, to prevent sediment passing into the pipe.

AN IMPROVED INKSTAND.

An inkstand designed to almost altogether prevent the evaporation of ink is shown herewith. It has been patented by Mr. Emry Davis, of Kane, Pa. The inkstand is closed air-tight by a cover, formed of an inner



DAVIS' INKSTAND.

annular concaved disk of soft rubber and an outer ornamental metal cover, flanged and threaded to the stand. In the cover is fitted a tube reaching nearly to the bottom of the ink well, the tube having a flange fitting closely the central opening of the rubber disk, and making an air-tight connection between the tube and cover. In the tube is placed a float, in which is placed a funnel or dip tube which reaches up through the annular cover, the lower end of the tube being open at the bottom to receive the ink. If desired, a light coiled spring may be used at the bottom of the float to lift it suddenly in the tube. In use, the float is held up by the buoyancy of the ink, as shown in full lines in Fig. 1. To fill the pen with ink, it is placed in the upper end of the dip tube and pressed down, as shown in dotted lines. The pressure lowers the float, and the air confined above the surface of the ink causes the ink to rise in the dip tube and fill the pen. On removing the pen, the float rises and the ink recedes in the dip tube, so that there can be practically no evaporation.

Electric Welding.

It was at a meeting of the Boston Society of Arts in the fall of 1886, where Prof. Elihu Thomson, the inventor of electric welding, first explained and illustrated by practical experiments the art of electrical welding, discovered by him, to a large and interested audience who could scarcely believe their eyes when they saw copper and iron rods one-half inch in diameter welded in a few seconds, together with other equally startling experiments.

Professor Thomson, like every great and original inventor, was impressed by the discovery which he had made, and eagerly followed up his experiments, conscious that he had solved the problem of how to spare human strength a large share of the extravagant waste expended to meet the requirements of an increasingly exacting and fastidious civilization. By careful study and patient perseverance, supplemented by elaborate facilities for experimenting, rapid and striking improvements were made in the mechanical and electrical apparatus employed in the art, until now, when the process may be, in a sense, considered perfected, or at any rate rendered in every way fit to be placed on the market as a great labor-saving device, and a method by means of which results in metallurgical art and science can be achieved which were utterly impossible until now.

It was to see these devices in practical operation that representatives of the scientific and daily press, numbering about 50, in response to the thoughtful invitation of General Manager H. A. Royce, of the Thomson Electric Welding Company, were recently given a reception, at the Malden, Mass., Electric Light Company's station, where three transformers, a 30-unit welding dynamo, and specimens of work in riveting, shaping, and welding were shown.

The proceedings were in charge of Manager H. A. Royce and several able assistants, well known electrical engineers. Together, these gentlemen manipulated the entire machinery and superintended the experiments, answering a multitude of questions and explaining in the fullest possible way, but in plain and unpretentious language, the entire process to the eager crowd of wondering, curious, and dazed visitors, who, almost to a man, found difficulty in expressing their astonishment, as they bewilderingly stood and watched the process of welding going on in almost every conceivable form, and between many different metals, including joints in lead, brass, and iron pipe, and quite a number of other forms of materials. The apparatus exhibited was of the indirect type, the welding being done on a transformer or "welding coil," receiving current from a dynamo. For small work the company manufactures a direct welding machine, in which the transformer is dispensed with and the current taken direct from the armature to the clamps attached to the field magnet of the dynamo. One-half inch bars of copper and iron rods from ¼ to 2 inches in diameter were repeatedly welded on the three transformers, all of which were used in order to show the ease with which various types of machines can be adapted to all classes of work. The smallest transformer, weighing 500 lb., was used in welding ⅝ copper, which is four times the size of the largest overhead conductor employed for electric railways. The strength of the joint was evidently greater than that of the rest of the rod, for, on twisting, it was broken at some distance from the weld. By a still larger transformer the method of butt welding extra heavy 2 inch iron pipes was shown. An absolutely tight joint obtained in this way is of great value in the manufacture of ammonia machines. The third transformer, welding 2 inch solid iron in less than two minutes, gives a current of over thirty thousand amperes and consumes about fifty horse power. The rapidity, ease, and certainty with which the work was done, the strength and good appearance of the welds, excited the admiration of all.

Blasting Holes to Plant Trees.

"Few people elsewhere in the world may ever have heard of blasting holes to plant shade or fruit trees," said a cultivator the other day, "yet the practice is common here and shows good results. In most places there is found sufficient top soil for any purpose, but as land has become valuable, people have cast about for means to utilize lands where the coarse sand rock comes too near the surface for successful tree planting. A blast, well put in, creates a pocket for broken rock mixed with top soil, which furnishes a basin to hold moisture as well as a deeper and cooler hold for the roots. It is yet too early to say what will be the ultimate results of such planting, but in a climate like ours, where a superfluity of rainfall is not likely to occur, it will no doubt be successful."—*San Diego, Cal., Union.*

AN IMPROVED SEAL-PRESS.

A seal-press or hand-stamp, so constructed as to prevent its use by unauthorized persons, is shown in the accompanying illustration. It has been patented by Mr. John G. Strodtmann, of Petersburg, Ill. The plunger is forced downward by a cam lever, a spring lifting the plunger when the pressure is removed. A lock is embedded in the standard so that its bolt will engage a notch or shoulder upon the plunger, the notch being so located upon the plunger that, to engage with the bolt of the lock, the plunger must be in its lower position, in contact with the die, as shown in the illustration, whereby the faces of the dies are made inaccessible when the press is locked. The notch of the plunger and the lock-bolt are also concealed and protected

STRODTMANN'S SEAL-PRESS.

within the press frame, the frame of the press being preferably made in two parts, divided in a central vertical plane, and permanently riveted together, the lock being held in an interiorly recessed portion, while the rivets uniting the parts are finished flush with the surface, and the frame thereafter japanned or otherwise finished in such manner as to conceal the position of the rivets. The lock may be a multitubular one which cannot be easily picked, and presents its keyhole and the end of the tumbler barrel only to view, flush with the side face of the frame.

Some Facts about Rubber.

At a recent meeting of the Merchants' Club, of Boston, Messrs. Geo. A. and A. H. Alden, rubber brokers, thus summarized the leading facts connected with the India rubber industry:

Rubber is a coagulated sap of the *Siphonia elastica* and its kindred genera, a tree, shrub, bush, vine, or weed producing merchantable quantities of rubber in Brazil, the North and West Coasts of South America, Central America, Mexico, East and West Coasts of Africa, and India. Even our common milk weed would produce a very fair rubber. The standard and most reliable rubber in quality, as well as the highest priced—the celebrated "fine Para biscuit"—is produced in Brazil, while the lowest grades and most irregular qualities are the productions of the West Coast of Africa; the latter, in fact, are even there deteriorating—due to carelessness or fraud on the part of the gatherers. We received from a manufacturer some little time since, by express, a hat, boots, and overalls, which, he wrote, he found in a ball of rubber, and that he expected to find the man before he got through with the lot.

The most interesting country in which to study the production of rubber is Brazil, where it has reached its highest standard in that region of heat and moisture, marvelously dense forests, and still more marvelous waterways, the Amazon valley, than which does not exist in the whole world a more fertile region for its size, with its rank growth of vegetation, rubber and dyewood trees, Brazil nuts, artistic woods, fruits, coffee, cocoa, cotton, the Cachassa berry—from which is produced the native rum—tobacco, sugar, and farinha plantations—farinha being the native flour of Brazil. This wonderful river, with its tributaries, drains a territory larger than the whole of the United States, the rise and fall of water between the wet and dry seasons being 45 feet and upward, so that, during the wet season, the rubber-producing districts (which cover a considerable portion of the valley) are flooded. And here let me say that the so-called rubber plant found in your houses, and admired for its beautiful foliage, is not the tree which produces the rubber of commerce.

Notwithstanding the excessive and continuous heat, the attendant and numerous discomforts always to be found in a tropical country, and the liability to dangerous sickness prevalent to a greater or less degree at different seasons, the valley is inhabited (very sparsely, it is true) by an industrious and hard-working people, as shown by the large and ever-increasing exports from Para, which is the principal shipping and receiving port for the valley, situated somes sixty miles from the mouth of the Amazon, on one of the many arms of the delta—a city of about 40,000 inhabitants, composed of Brazilians, Portuguese, negroes, and half breeds, with a few American, English, German, and French, who are located there to buy and ship the produce as it arrives.

The rubber is only gathered on the Upper Amazon during the dry season, when the heavy daily rains of the wet season have ceased and the river has contracted itself within its banks. The flooded country gradually becomes less and less marshy, and enables the laborers to penetrate the forests fringing the water courses, to tap the trees. Without experience it is difficult to form an adequate idea of the almost impenetrable vegetable growth on these annually flooded bottom lands, under the influence of an equatorial sun.

At the beginning of a season, say the latter part of May or the early part of June, the emigration of laborers to work on rubber estates is very marked, the steamers from the south (mostly from the province of Ceara) going up the Amazon loaded with rubber gatherers, many of whom return again in the autumn when the rainy season commences. Those who remain live a most indolent life in lightly built bamboo huts, perched on piling to elevate them above the rising waters.

On the lower Amazon, among the islands, rubber is collected and brought to market every month in the year; but the rubber from the upper river gathered during the dry season only reaches market in the wet season, for the double reason of the necessity for high water to enable the river steamers to reach the higher branches of the river and the enormous distances required to be sailed over by these steamers, whose trips into Peru and the head waters and back cover a greater distance than from here to Liverpool and back, and consume a greater time. Between Para and the Andes Mountains there are 30,000 to 40,000 miles of navigable water of the Amazon and its tributaries.

The rubber from this valley was formerly brought to market in the shape of bottles and shoes, made by the natives over clay moulds, which were then broken and taken out. This method was continued until about 1848 or 1849, when a wooden mould, something after the shape of a paddle, was adopted by the gatherers, and is exclusively used to-day.

Grants of seringoes, or rubber lands, are made by the provincial governments upon application of discoverers or explorers of same, on the condition of their occupying and working the trees, which are in turn mortgaged to the Para or Manaos merchants as security for the advancement of supplies to the gatherers against rubber to be delivered throughout the crop. Nearly all the available lands are thus taken up, although not all thus pre-empted are worked. These seringoes exist not only on the river margins, but in the interior as well—always, however, in low districts of a swampy nature, near or around lakes or ponds; and from these inland lakes small streams drain into the river, down which the rubber is floated to the forwarding points for shipment to Para.

Some of the seringoes are very extensive, and many men are employed—divided into gangs—some to keep the paths open from tree to tree by constant chopping and cutting at the wild and luxuriant vegetable growth which would otherwise choke up the paths and render them impassable in a short time. Another gang gathers the milk or sap of the tree, by cutting into the bark in a V-shape, and sticking to the tree at the point of the V a small clay cup or saucer of about two gills capacity, into which the white, milky sap slowly trickles. It is then collected, brought into camp, and distributed in large basins among the makers, each of whom has a smouldering fire of nuts covered by a portable clay chimney a foot or so high, from which issues a dense, black smoke. The operation is then a very simple one. The maker covers his paddle with a thin layer of sap, which naturally adheres to it, holds it in the smoke for a moment, at once coagulating it. He then adds another layer, by dipping, and again holds his paddle in the smoke. This operation he repeats again and again, until the merchantable "fine Para biscuit" is produced. The paddle is cut out and the operation repeated.

The biscuit, when finished and cut from the paddle, contains 56 per cent water, which must be wholly evaporated before it is ready to be put into goods. This loss is divided between the different parties who handle it. The greatest loss is between the camp and Para, where every biscuit is cut for grading of quality. The sweepings of the camp, drippings of the trees, and cleanings from the basins, etc., are more carelessly rolled together into scrappy balls, which are termed negro-heads. In Ecuador, the sap is floated on to water and mixed with ashes and other foreign stuff to hasten its coagulation, not to mention that it increases its weight.

In Nicaragua, the sap is drawn into tin dishes and is coagulated by mixing with the bruised leaves of a plant which flourishes in that vicinity.

The natives in Africa have a method of gathering by smearing the sap on their naked bodies, coming into camp veritable living rubber men.

The product of rubber of the Amazon valley has more than doubled in the last ten years. The crop ending the summer of 1878 was 7,598 tons, while last year's crop was 15,725 tons. The total consumption of all grades of rubber in the United States last year was 30,000,000 pounds, the value of which was about $15,000,000.

The Brazilian governments—imperial and provincial—collect an export duty of 22 per cent on the market value, at the time of shipment, which amounted to about $5,000,000 last crop.

In the manufacture of rubber goods, more than 30,000,000 pounds of metallic oxides and carbonates are used. In addition, large quantities of earthy materials are used, principally to make weight. Cotton and woolen cloths are consumed to the extent of 20,000,000 pounds. Devulcanized or reclaimed rubber, amounting to 25,000,000 pounds, is also used. This includes almost all the cast-off rubbers, for these old goods eventually find their way back to the mills to be ground up and made into shoes again. This old rubber is worth from 8 cents to 30 cents per pound, according to quality. Without this old stock to draw upon, rubber goods would be a great deal more expensive to the consumer. The capital invested in rubber mills in the United States exceeds $25,000,000, employing a large number of people—men, women, and girls. The value of rubber thread, toys, etc., made amounts to $5,000,000; clothing, $5,000,000; mechanical goods, $15,000,000; and boots and shoes, $28,000,000. The number of boots and shoes made daily for nine months in the year will foot up to 150,000 pairs.

The First Inventor of the Monitor Turret.

A correspondent of the Washington *Star* rightly says the real inventor of the monitor revolving turret was not Captain John Ericsson, but Theodore R. Timby, a native of New York State and now a resident of New York. The writer asserts that the contractors for the building of the Monitor, Messrs. John F. Winslow and John A. Griswold, of Troy, N. Y., C. S. Bushnell, of New Haven, Conn., and others, paid Mr. Timby $5,000 for the use of his invention in the construction of that vessel, and a like sum for each turret constructed by them in the building of other ironclads for the government. The following documentary evidence is presented to substantiate the claim:

First, a letter of Mr. Timby to Rear Admiral Ammen, under date of March 7, 1888, which is sworn to by the former. In this letter Mr. Timby states that the first sight of the circular form of Castle William, on Governor's Island, suggested to him the idea of the revolving plan for defensive works, and in April, 1841, when he was 19 years of age, he came to this city and exhibited a model and plans of a revolving battery, to be made of iron, to the then chief of engineers and chief of ordnance. "In January, 1841," Mr. Timby continues, "I made a model of a marine turret, which model is now in my possession. At this date I made my first record in the United States Patent Office, and from Jan., 1841, to 1861, I continued to urge the importance of my plans upon the proper authorities at Washington and elsewhere." He adds that he took out patents in 1862 covering the broad claim "for revolving towers for offensive or defensive warfare, whether placed on land or water." Extracts are quoted from the Patent Office records showing that a caveat was filed January 18, 1843, and a patent was issued September 30, 1862. In that year he says that he entered into a written agreement with the contractors and builders of the original Monitor, John F. Winslow and John A. Griswold, of Troy, N. Y., C. S. Bushnell, of New Haven, Conn., and their associates, for the use of his patents covering the turrets, by which they agreed to pay him and did pay him $5,000 as a royalty on each turret constructed by them.

Recent Changes at Niagara Falls.

There have been recently two very heavy falls of rock at Niagara Falls. At first a mass of rock fell from the Horseshoe Falls, and twenty-four hours later another mass was precipitated into the abyss below, with a noise so closely resembling that of an earthquake as to alarm the residents of the neighborhood. The result of the displacement is a change in the shape of the fall. Formerly the Canadian portion of the fall could be described as a horseshoe; but the breaking away of rocks in the center some years ago made it V-shaped. Now that a further displacement has occurred, the fall has returned to its old condition. It is, of course, generally known that the falls of Niagara are gradually moving to the south. The deep cut through the solid rock marks the course they have taken in their backward movement. It is a wonderful excavation, a chasm dug out by the sheer force of water.

Not less astonishing has been the removal of the debris. The rock has been thoroughly pulverized, and has been swept out of the river, to be distributed in Lake Ontario. Once it was thought that in the wearing away process the falls would reach Lake Erie, and there degenerate into a series of rapids. But the theory has been set aside by one which retains the cataract, although the latter will be the shadow of its present self, and much reduced in size. The latest idea is that the falls will recede two miles and then remain stationary, their height at that point being 80 feet, instead of 164, as at present. The supposition is supported by an argument which appears reasonable. The present site is a limestone formation, some 80 or 90 feet thick, with a shaly foundation. As the shale is washed away the limestone breaks off, and the falls take a step backward. But the end of the shaly deposit will be reached two miles from the present falls, and then the rushing water will have more than it can do to wash away the solid precipice over which it will be projected. *Iron* suggests that it would be a waste of time to attempt to estimate the number of centuries that will elapse before Niagara Falls will have found their permanent site.

What Invention Has Done for Milling.

In his speech at the Smith purifier banquet in Jackson, Hon. H. A. Hayden, the Jackson mill owner, gave some interesting personal reminiscences. It seems that he started in the milling business in 1845, in a little custom mill three miles south of the city of Jackson. He had enlarged gradually, and within a year or two had been able to turn out 8,000 barrels of flour a year, which he considered a big business. He then increased his capacity to fifty barrels a day by the addition of three runs of stones—the old flat burr stone, capable of grinding five or six bushels an hour with one half chest of reels.

The best cloths used in those days were No. 10, and the bulk of the flour was made with No. 9. But the product was good for those days, and found a ready market. Then came a demand for better flour. Up to this time millers had considered middlings as offal, and it was run through the flat stones and made into a low grade flour which was hard to sell. After a few years he had purchased other mills and adopted modern inventions as rapidly as they were offered, but always with a feeling of distrust in "new-fangled fixin's." Millers in those days worked from daylight until the day's work was done, be it 9, 10, or 12 P. M. They were not afraid of work, and to this labor the speaker largely attributed his success.

When the new process was talked of, he had considered it foolish, but he was finally forced to acknowledge that with it the best grades of flour could be made from material thrown away in the old methods. He reluctantly adopted the rollers instead of stones and remodeled his mill. The success was far greater than had been thought possible. Other improvements followed, and to-day the finest grades of flour are made where the best flour of years ago could not be sold at any price.

The Loom.

At a recent meeting of the Manchester Association of Engineers, Mr. C. P. Brooks read a paper on "The Loom: Its History, Use, and Construction." He said the loom occupied a highly important place among the machinery employed in the industries of England, as they would realize when he stated that in 1885 there were 773,704 looms working in the United Kingdom, 560,995 of which were engaged in the cotton trade, while this year 450,000, or nearly three-fourths of the cotton looms in the kingdom, are working within a radius of 30 miles from Manchester, or, if the radius were increased to 50 miles, they found 600,000 looms within the extended distance—facts which in themselves should serve to draw their attention to an apparatus of such value and utility to the cotton trade of this country.

After giving a detailed history of the invention of the loom, the work it performs, and also various other facts in connection with it, Mr. Brooks observed that the production was one point which had been greatly improved during the past half century. In 1830 looms were running at 130 picks per minute, now an average width of loom was run at 200 picks per minute; and while, according to Edward Baines, the historian of the cotton trade, a steam loom weaver in 1823 attended to two looms, four were minded at present. This increase, however, did not strike one as being phenomenal, when the great strides obtained in other industries were considered, and he had no doubt there was still room for great improvement in this respect.

It was a notable fact that the inventions of the power loom, and many subsequent improvements and attachments, were attributable to others than those engaged in the trade, or even others than engineers. A minister, a calico printer, and a cutler and typefounder had all left their impress upon the weaving branch of the cotton trade, while Arkwright, the barber, and Hargreaves and Compton, the weavers, were important inventors in the spinning branch. However, invention seemed now to be organized as a profession, and he had no doubt that cotton machinists would not lose sight of them for improvements that might be made in the future.

In his opinion, one of the points that required attention in loom making was additional speed, which was difficult to attain. As at present constructed, the loom worked worse, caused more spoiled cloth, and even in some instances gave less production, if speeded, so that to attain the desired object the loom must be improved in its working parts, so as to give less vibration and manipulate the threads more tenderly. This would have in some measure to be attained by planing all points of the framework, hardening the working parts, and also by other means which would suggest themselves. The further simplification of the loom was also desirable. It was not now by any means an intricate machine, except the loom for fancy weaving; but the simpler the loom could be made the better, and the limit in this direction had scarcely been reached. The fancy branch of cotton weaving seemed to be developing, and there was, he had no doubt, a field opening up in which cheap, simple, and effective machinery for fabricating the ornamental cotton cloths would have great success.

SOME EXPERIMENTS IN SOUND.

BY GEO. M. HOPKINS.

The most perfect exhibition of vibrating flames can be made only with expensive apparatus; but the student can get very satisfactory results by the employment of such things as are shown in Fig. 1. A candle, a rubber tube, an oblong mirror, and a piece of thread are the only requisites, excepting the support for the mirror—which in the present case consists of a pile of books—and a little paper funnel inserted in the end of the rubber tube and forming the mouthpiece.

The thread is tied around opposite ends of the oblong mirror, and the mirror supported by passing the thread

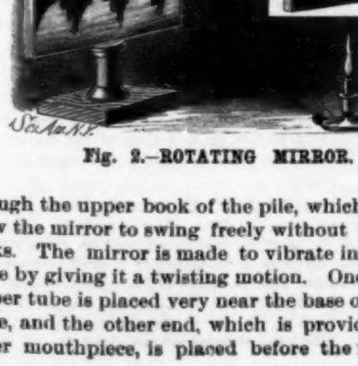


Fig. 2.—ROTATING MIRROR.

through the upper book of the pile, which juts over to allow the mirror to swing freely without touching the books. The mirror is made to vibrate in a horizontal plane by giving it a twisting motion. One end of the rubber tube is placed very near the base of the candle flame, and the other end, which is provided with the paper mouthpiece, is placed before the mouth and a sound is uttered which causes the air contained by the rubber tube to vibrate and impart its motion to the candle flame. The vibratory character of the flame is not noticeable by direct observation, but on viewing the flame in the swinging mirror, separate images of the flame will be seen. These images are combined in a series which, with a certain degree of accuracy, represent the sound waves by which the fluctuations of the flame are produced.

To show that these images result from a vibrating flame, it is only necessary to view the flame in the mirror. When no sound is made in the mouthpiece, only a plain band of light will be seen.

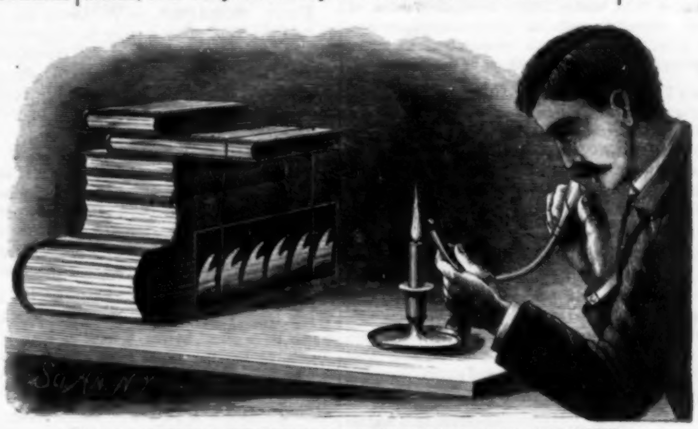


Fig. 1.—SIMPLE METHOD OF PRODUCING AND VIEWING VIBRATING FLAMES.

A somewhat more convenient arrangement of mirrors is shown in Fig. 2. In a baseboard is inserted a wire, one-eighth inch or more in diameter and about a foot long. On this wire is placed an ordinary spool, and above the spool a thin apertured board (shown in the detailed view), the board being about 8 inches long and 6 inches wide. The board is perforated edgewise to receive the wire. In the upper edge of the board, half way between the center and end, is inserted wire, upon which is placed a small spool, serving as a crank by which to turn the board. Upon opposite sides of the board are placed mirrors of a size corresponding to

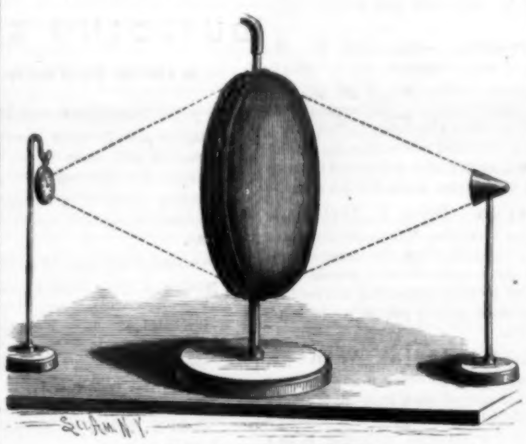


Fig. 3.—SOUND LENS.

that of the board, the mirrors being secured to the board by strips of paper or cloth pasted around the edges. The image of the flame is viewed in the mirrors as they are revolved.

In Figs. 3 and 4 is illustrated an adjustable lens for showing the refraction of sound. The frame of the lens consists of three 12-inch rings of large wire, soldered together so as to form a single wide ring with two circumferential grooves. In the central part of the ring, at the bottom, is inserted a standard, and in the top is inserted a short metal tube. Over the edges of the ring are stretched disks of the thinnest elastic rubber, which are secured by a stout thread wound around the edges of the rubber, clamping them in the grooves of the ring.

By inflating the lens through the tube with carbonic acid gas, it may be focused as desired. A watch placed at the focus upon one side of the lens can be distinctly heard at the focal point on the opposite side of the lens, when it can be heard only faintly or not at all at points only slightly removed from the focus, thus showing that the sound of the ticking of the watch has been refracted by the lens, in much the same manner as light is refracted by a glass lens.

The Light of Shooting Stars.

While commenting on a memoir presented to the Academy of Sciences, M. Cornu gave it as his opinion that the light emitted by shooting stars is not due to conflagration or to the heat of impact. In those high regions our atmosphere is too unsubstantial to render the explanation acceptable. It is much more likely the phenomenon is one of static electricity developed by simple friction, and it is well known that rarefied gases can be made to glow intensely with but very little electric fluid.

Promoting German Industry.

The Society for the Promotion of Industry, Berlin, has just offered about $5,250 in prizes for solutions of various problems. For the best treatise on mechanical engineering applied to the construction of machinery, 5,000 marks = $1,250 and a silver medal are offered; while $750 and a silver medal are to be given to the best chemical and physical inquiry into the nature of iron paints most used. The greatest prize is to be given to the most meritorious solution of the point as to how far the chemical composition of, and particularly the amount of carbon contained in, steel is a standard for the usefulness of cutlery and edge tools. The amount offered, in addition to a silver medal, is 6,000 marks = $1,500, of which 3,000 marks = $750 have been granted by the Minister of Commerce; 4,000 marks = $1,000 are to be given for the best description and actual estimate of such elevators as are most generally constructed for hoisting passengers, baggage, and goods in factories, hotels, public and private buildings, arranged after their different kinds, as well as of the necessary safety precautions and their tests, and of the regulations of police and trade companies for the building and management of these lifts, the cost of construction, the working expenses, and necessary space. A silver medal and 3,000 marks = $750 is to be given for a description of the chemical processes which take place in producing pure cellular fluid from wood and other vegetable substances by means of soda and other sulphide processes. For the second best answer the Society of Wood Cellular Material Manufactures have offered a prize of 1,000 marks = $250. The time given for the answers is to November, 1890, but in the case of the query regarding iron paints the time allowed is to November, 1894.

The Industrious Squirrel.

A Danbury farmer points to the squirrel as affording an instance of agility, quickness, and hard work. Last fall he stored several bushels of butternuts in the second story of his corn house, and recently he noticed that they were disappearing much faster than the legitimate demands for his family supply warranted. He discovered soon afterward that a squirrel, a small red one, which the farmers' boys call "chipmunks," had found a hole under the eaves of the building, and was stocking her storehouse with the nuts the farmer had gathered. As an experiment to learn how rapidly the squirrel had worked, he removed all but twenty of the nuts and set a watch upon them. Six hours afterward every nut was gone. The distance from the corn house to the tree where the squirrel had its nest was just eighty rods. In going for a nut and returning with it the sprightly little animal had to travel a distance of 160 rods. Computation showed that the theft of the twenty nuts required just ten miles of travel. But this did not include all. Several times dogs frightened the squirrel, and it had to turn back, and twice the family cat got after it, requiring it to take a circuitous route to reach the storehouse. The nest was examined soon afterward, and a big, fat, lazy male squirrel was found snoozing quietly while his little mate was performing a prodigious feat to supply him with food. —*N. Y. Sun.*

The Paradoxes of Science.

The water, says a writer in *Blackwood's Magazine*, which drowns us, a fluent stream, can be walked upon as ice. The bullet which, when fired from a musket, carries death, will be harmless if ground to dust before being fired. The crystallized part of the oil of roses—so grateful in its fragrance, a solid at ordinary temperatures, though readily volatile—is a compound substance containing exactly the same elements, and in exactly the same proportions, as the gas with which we light our streets. The tea which we daily drink with benefit and pleasure produces palpitation, nervous tremblings, and even paralysis, if taken in excess; yet the peculiar organic agent called theine, to which tea owes its qualities, may be taken by itself (as theine, not as tea) without any appreciable effect. The water which will allay our burning thirst augments it when congealed into snow; so that it is stated by explorers of the Arctic regions that the natives prefer enduring the utmost extremity of thirst rather than attempt to remove it by eating snow. Yet if the snow be melted, it becomes drinkable water. Nevertheless, although, if melted before entering the mouth, it assuages thirst like other water, when melted in the mouth it has the opposite effect. To render this paradox more striking, we have only to remember that ice, which melts more slowly in the mouth, is very efficient in allaying thirst.

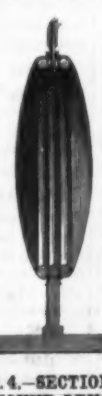


Fig. 4.—SECTION OF SOUND LENS.

RECENTLY PATENTED INVENTIONS.

Mechanical.

PLANING MACHINE CUTTER HEAD.—Victor V. Lawrence, Waterford, Vt. This head is made with end pieces having short integral journals projecting from their outer sides, parallel portions connecting the end pieces, which are separated by a clear space extending their whole length, and have flat inclined knife beds tangential to the axis of the cutter heads, leaving room for the clips, the invention also covering various other novel features.

MACHINE FOR CUTTING PATTERNS.—James W. Dearing, Brooklyn, N. Y. This machine provides means for manipulating a knife while in motion, and wherein the knife may be actuated by connection with any piece of mechanism having a vertical reciprocating motion, as the needle bar of a sewing machine, etc., being especially adapted for cutting scalloped edges and similar forms.

DYNAMO-ELECTRIC MACHINE.—Joseph W. Balet, New York City. This machine has an armature core grooved longitudinally with respect to the armature and transversely with respect to the field magnet, there being combined therewith one or more conductors wound in the grooves of the armature, so that the fluctuations of the current induced in the armature will not react upon the field magnet to modify the lines of force and cause the current to fluctuate.

DEVICE FOR TRANSMITTING POWER.—William G. Scott, Starkville, Miss. This is a pneumatic device which combines with a fixed air compressing cylinder and its piston a loose cylinder, a flexible tube connecting the latter with the fixed compressing cylinder, a spring-controlled piston in the loose cylinder with a hammer head on its front face, with other novel features, for transmitting power by blows or impact.

Agricultural.

PRUNING SHEARS.—James R. Gascoigne, Devenport, New Zealand. This invention covers a novel, irregular, and scalloped construction of the blades of the shears, whereby the twigs and branches are held from slipping, and the cutting edges can be readily sharpened, while the tool is intended to enable the operator to do more and better work.

Railway Appliances.

SNOW PLOW.—Eric M. Hesselbom, Rushford, Minn. This invention covers a novel construction and combination of parts in a plow designed to cut up the snow and discharge it in two streams to the side of the track, the plow being driven by a locomotive in its rear, and the invention being an improvement on a former patented invention of the same inventor.

Miscellaneous.

FOLDING BOOK CASE.—Phillip Kaffenberger, Springfield, Mo. This invention provides a permanent shelf upon which a permanent piece is supported at each end, such pieces forming portions of the sides and combining with those permanent parts, folding sides, and removable shelfs, giving rigidity to the entire structure, while the case may be folded into small bulk for transportation.

WATER PURIFIER.—Thomas H. McCulloch, Omaha, Neb. This device may also be used for other liquids, and comprises a series of settling tubes, the first tube having an inlet pipe at its lower end and an outlet at its upper end, pipes connecting the tubes, the upper end of each pipe communicating with the interior of a tube at its upper end and the lower side of the adjacent tube, with other novel features.

GAS CHECK.—Henry B. Eareckson, New York City. This device is for use on the waste pipes of wash basins and other water fixtures, to permit the discharge of the waste water while automatically preventing the back flow of sewer gas, the invention providing for the ready inspection and removal of the flap valve and its operating connections for cleaning or repairs, and to secure increased simplicity and efficiency.

KITCHEN CABINET.—Charles B. Rogers, St. Peter, Minn. Combined with a case having a cleat across its back and a moulding along the lower part of its rear edges are shelves hinged to the side of the case, and provided on their rear edges with rearwardly projecting strips adapted to engage alternately the cleat and the moulding, with various other novel features.

COFFEE POT.—Edward T. Newlin, Brooklyn, N. Y. This is one of the class of coffee pots in which an infusion is obtained by passing water through the ground coffee, held in a fabric strainer near the top of the coffee pot, the invention consisting mainly in a compressible ring held in the margin of the strainer, and in a removable support for the latter.

ASH SIFTER.—George W. Bown, Philadelphia, Pa. This invention covers a novel combination of parts in an ash sifter in which the parts may be detached, the casing being easily applicable to a barrel, so the ashes may be thus sifted, or the sieve may be locked to an ordinary ash pan, converting the two into a sifter.

FENCE MACHINE.—George W. Johnson, Dallas, Oregon. This machine is specially adapted for forming easily and rapidly fences of wires and pickets, the machine consisting principally of a tension device and a crossing device, and the invention covering various novel details and combinations of parts.

TENSION DEVICE.—Gabriel D. Coiner, Koiner's Store, Va. This is a device for use in making fences, and consists of a vertical standard supported rigidly on a broad base, a removable guard plate being rigidly attached to the face of the standard, and pins projecting from the standard, with other novel features, the device being moved from point to point as the fence making progresses.

HORSE DETACHER.—George T. Parker, Glasgow, Ky. In connection with a holdback hook for use on vehicle shafts, a dog and a presser acting on the dog are used to secure the latter in position in such manner that the ring connected with the breeching strap may be conveniently adjusted into the hook and may be released therefrom when the horse moves forward out of the shafts after the traces have been unfastened.

SLED BRAKE.—Clarence E. Holley, Fort Fairfield, Me. This brake is made with an endwise or longitudinally movable plate or bar having connection with the longitudinally movable tongue, in combination with brakes having a whiffletree-like or cross bar connection with the longitudinally movable bar or plate, the brakes each consisting of an elbow lever pivoted at its angle to a runner of the sled.

WEATHER STRIP.—John E. Jones, New York City. This invention covers, as a new article of manufacture, a weather strip having a compressible and anti-friction surface of cork, composed of short blocks of cork applied to the door or window, with the ends of the grain at right angles to the edge of the window or door, the cork being held in a suitable casing in grooves.

WEATHER STRIP.—The same inventor has likewise obtained a further patent for a weather strip composed of a thin plate of spring metal set into the edge of the sash, so that its outer edge presses with a constant spring pressure upon the window frame, being designed to be used mainly on car and other windows to exclude air, dust, rain and snow.

FOLDING CONFESSIONAL.—James J. Dunn, Meadville, Pa. This device consists in a middle screen having a window or opening in its upper part, and outer screens hinged to the same vertical edge of the middle screen, being intended for use in Roman Catholic churches, where it can be readily set up in any part of a church, or readily folded up and removed out of the way.

AIR SHIP.—Herman A. J. Reickert, New York City. This air ship consists principally of a balloon supporting on its under side a closed basket, in which is located a motive power operating a suction wheel and propeller wheel, both located above the basket at its rear and mounted in supports connecting the basket with the balloon, the power also operating side and central wings, and the ship being designed to be under the control of the operator, to be steered in any direction.

WINDMILL.—George W. Haines, Adin, Cal. This invention provides means for regulating the windmill, whereby the wheel will be kept turning at a regular speed in all winds, high and low, and wherein the turn table will be constantly and automatically lubricated.

WIRE TIGHTENER.—Shapley P. R. Taylor and Stephen S. Clark, Denison, Texas. This is a simple tool for taking up the slack of wire in wire fences, and has a peculiar construction and arrangement of a twisting nipper, in which a bar having a forked end bent to form hooks is combined with a lever handle fulcrumed to the bar, and having its end extended between the hooks to form a discharging device for the wire.

SHOEING STAND.—John J. Halstead, Keeler's Cross Lanes, West Va. This is an apparatus designed to save the horseshoer from the strain of supporting the foot of the animal, and also provides for more firmly and more steadily supporting the hoof, so that the shoe can be more quickly put on, while it has a convenient tool box.

RENDERING.—Frederick Winter, Allegheny, Pa. This invention covers a novel process for the manufacture of neutral stock from crude animal fats, by first reducing the fat to a pulp, then passing it on to a body of heated water, next subjecting it to a stream of heated water from above, whereby the melting is completed, and foreign matters washed out, then, after settling, drawing off the clear fat.

SIFTER.—George H. Fountain, Plainfield, N. J. This invention provides a sifter with a perforated or reticulated drum having an automatically closing door, with means whereby a chute or slide may be expeditiously constructed to carry off the sifted products when desired, the construction being simple, durable, and economical.

WATCH BOW FASTENING.—Frank G. Faxon, Mount Morris, N. Y. Combined with the watch bow is a divided pendant, between whose members the ends of the bow are clamped, and which are relatively adjustable to bring them into closer relation, the bow being held in such manner as to render it impossible to accidentally detach it from the pendant.

FARE BOX.—Timothy L. Beaman, Knoxville, Tenn. This invention covers novel features of construction and combinations of parts in a fare box designed to be proof against robbing implements in the hands of the driver or other person, while the box is made strong and generally efficient for its purposes.

SIGNAL BOMB.—Reginald H. Earle, St. John, Newfoundland. This is a bomb designed to be used as a marine signal, and is so made as not to be affected by dampness, and so it can be ignited irrespective of the state of the weather, while in exploding it will send aloft a heavy volume of flame and smoke and give a heavy detonation.

STEREOSCOPE.—Adelbert E. Foutch, New Albany, Ind. This device has an endless series of view holders distended upon rollers, a set of journal plates arranged to slide horizontally in guides and carrying the rollers, toothed gears for adjusting the plates horizontally, and a sliding bevel gear connection with the roller for rotating the series of view holders, the views being arranged in endless series to be successively brought into focus of the lenses.

LUNCH HEATER.—Timothy O'Mahony, Felton, Cal. This is a cylindrical heater constructed of sheet metal and having an open top, with inwardly projecting arms for supporting a dinner pail, and notched lugs for connecting with studs on the pail.

PAPER BOX.—John F. Diemer, Elizabeth, N. J., and Paul E. Gonon, New York City. This is a knock-down paper box especially adapted for filing or storing papers, bills, etc., and is so made that when set up it is provided on each corner on the outside with an angular metallic strip, whereby the box body becomes very strong.

CHECK BOOK.—Henry R. Wilson, Brooklyn, N. Y. This invention covers an attachment for check books to be used as a stub holder and check cutter, and consists of a cutter bar and a flexible connection pivoted thereto and arranged for loose connection with the book cover.

FOOT SCRAPER.—William H. Tyler, David City, Neb. This scraper is formed of a single piece of sheet steel, having at the extremities of its scraping edge rounded ears for engaging the soles of a boot or shoe, and having feet formed by splitting the plate and bending the split portions in opposite directions.

TRUNK ATTACHMENT.—Joseph Ware, Brooklyn, N. Y. This is an attachment to secure the trunk when closed, and enable it to withstand severe handling and rough usage, and it consists of battens connected together to extend over the trunk, blocks and tackles connecting two of the battens together for tightening and securing the battens to the trunk.

REEL AND SPRINKLER.—Richard Wylie, Napa, Cal. This invention combines a tubular frame on wheels, having a handle, with a series of sprinkling nozzles on its front end, the tubular axle having a tubular connection with the sides of the frame, with a connecting hose wound on the reel, whereby, when the machine is pushed or drawn along, the passage of water through the axle and frame may be maintained.

GARMENT SUPPORT.—Charles R. Hollis, Pittsfield, Mass. This invention relates to supporters for holding up children's drawers and stockings from the waist, for which the invention provides a convenient and readily attachable spring device which permits of the free and easy movement of the child's body without any strain upon the drawers and the loops.

BUCKLE.—Sallie C. Tucker, Garnett, Kansas. This buckle consists of two parallel end loops connected at their lower outer corners by a cross bar, and also connected above the bar by a horizontal loop, the upper and lower bars of which are in vertical alignment, whereby two tape or strap passages cross each other, and either tape or strap may be adjusted without interfering with the adjustment of the one crossing it.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(570) S. V. asks how to color metal with aniline colors and produce the matte or dull effect as contrasted to the bright and polished. A. Try dissolving the colors in photographer's ground glass varnish. A simple application of the alcoholic solutions will leave a dead color on the metal, but this will not be permanent unless varnished, which of course will tend to brighten the surface.

(571) G. C. M. writes: Considerable sport is being had out of the horse question. The question is: A man sold a horse for $80, bought him back again for $70, and sold him a second time for $100. What did he make in the transaction? A. The question is a "catch." At the end of the transactions the man was to be debited with $180 and credited with a horse and $70. If the horse was worth more than $110, he lost the equivalent of the excess. If worth less than $110, he made a profit equal to the difference.

(572) J. W. D. asks (1) how wire solder is made. A. Wire solder is made by punching small holes, from one-thirty-second to one-sixteenth inch diameter, in the bottom of a sheet iron pan along one side, holes to be one-half inch apart. Set the pan upon a flat plate of iron or a flat stone slab, pour in the solder, and tip the pan so that the solder will flow through the holes, drawing the pan along the slab fast enough

to leave trains of solder cooling in the form of wires. This will require a few trials to succeed well and make the wire even. 2. How to true or correct the balance of platform scales. A. Scales made by different makers require different treatment. You had better write to the makers of your scales for directions.

(573) X. T. Y. D. asks: 1. Can I assay copper ore by pulverizing, dissolving in sulphuric acid, and precipitating with iron? A. You cannot dissolve copper ore as you describe. Sometimes it is dissolved by the use of bromine or chlorate of potash with acids. The copper can be precipitated with clean pure iron wire. 2. I have some fine wood cuts; how can I varnish them so that the printing on the other side will not show? A. Size the pictures with white glue and varnish with dammar varnish.

(574) H. S. W. asks where he can obtain information in regard to building a boat called a "Barnegat sneakbox." A. The usual length of a Barnegat sneakboat is 12 feet, width 4 feet, square stern 34 inches wide, 7 inches deep. Midship depth 16 inches, low sides. Flaring canvas deck. Cockpit, 7 feet long by 19 inches wide, with wood combing. Rowlocks raised 8 inches and made to fold in when not in use. Can be clinker built, with frame, or, as often built, like a skiff, for which see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 25 and 26, "How to Build Skiffs."

(575) B. S. asks: 1. Has it not been proved theoretically and practically that to obtain the highest efficiency of an hydraulic propeller, the water must be ejected above and not below the water line? A. No. This is theoretically and practically a failure. 2. Has by practical tests any considerable success ever been attained with an ejection below the water line? A. All efforts at hydraulic propulsion have heretofore proved failures. 3. Where can I find the best records of such tests? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 354, 415, on hydraulic propulsion.

(576) E. L. A. asks: 1. Is the eight-light dynamo described in SUPPLEMENT, No. 600, large enough to charge storage batteries sufficient to run 20 incandescent lamps? A. Yes, it will charge them at a reasonably good rate, say at 8 to 10 amperes. 2. If not, how many will it run, 16 candle power? A. The dynamo will run 8 to 10 such lamps. 3. How many storage batteries will be required? A. For fifty-volt lamps you will need twenty-five cells in series. 4. What SUPPLEMENTS describe storage batteries and how to make them? A. Nos. 688, 459, 600, 625, 626, and many others.

(577) W. A. R. asks: Is the bottom of a kettle of boiling water hotter or colder than the water when boiling, the kettle remaining on the fire? A. It is hotter than the boiling water.

(578) J. E. A. writes: 1. Has there ever been a locomotive driven by electricity generated with a galvanic battery? A. Many years ago experiments were tried by Dr. Page in this direction, but the expense of driving such motors proved too great. 2. If so, what battery was used? A. We presume a copper zinc couple excited by sulphuric acid was used. 3. What galvanic battery will give the best results in driving an electric motor, where cost is no consideration? A. A large Bunsen battery is about the best.

(579) C. F. J. writes: Can you advise me how treat a steel woven-wire mattress so that it will withstand the action of dampness and not rust when used in a small yacht? The cloth-covered mattress placed on it will sometimes be perceptibly damp to the touch. A. We can only suggest painting or varnishing. These will tend to preserve it, but will not be very effectual.

(580) J. S. Van D. writes: 1. There is a small glass globe (about 2 in. in diameter) exhibited in show windows, containing a revolving fan made with diamond shape wings covered with tin foil or silver leaf, suspended vertically in globe. It may be a vacuum, and motion caused by light or heat; tell me cause of motion, and how they are constructed. A. See our SUPPLEMENT, Nos. 13, 26, 37, 69, etc., for description, etc., of radiometer. The motions of the molecules of highly rarefied air in the globe cause it to rotate. 2. Will city illuminating gas under pressure blown upon lime without the aid of oxygen produce intense heat enough to make the Drummond light, to be used for magic lantern purposes? A. No; you must use oxygen gas. 3. Would the gas produce more heat on lime by having the tube through which the gas passed highly heated previous to its being burned at the nozzle or jet? A. Yes; but hardly intense enough to produce a good light.

(581) H. C. W. writes: I have a few ordinary lime crystals, and I wish for curiosity to color them blue or pink or some other colors. I read some time ago that the Germans have some method. Can you furnish me with the information? A. We doubt if you will succeed in coloring your crystals. Try aniline colors dissolved in water, in which you may boil the crystals.

(582) C. J. L. asks: What causes the musical sound produced on the tumblers partly filled with liquid and rubbed on the rim with the finger? Is there any preparation placed on the finger? A. The friction of the finger makes the glass vibrate and produce sound. The finger should be wet, or resin may be applied to it.

(583) A. S. E. asks: 1. In a frictional electric machine plate, will shellac decrease the amount of electricity generated? A. No; but if applied to the glass plate, it would soon rub off. If then the partially stripped glass plate is used, an interference of positive and negative electricity may ensue, so as to cut down the amount produced. 2. What is the formula for making the chromates of Fe, Zn, Cu, etc.? A. Treat the hydrated oxides of the metals with aqueous solutions of chromic acid in cases where the desired chromates are soluble; where insoluble, mix the soluble salts of the metals with potassium chromate, both in aqueous solution. 3. Is there any SUPPLEMENT of the SCIENTIFIC AMERICAN containing directions, etc., for making frictional machines? A. No. 4. If, in an electrical machine, two plates are made to revolve in different directions on either side of a fixed plate, does the electricity generated amount to more than when the plates revolve the same way? Also, effect of middle plate turning in opposition to other two? A. It is a matter of experiment. You do not clearly state the conditions. 5. Can a chemist practice assaying in his own name, without being a graduate of any liscensed college, or having a diploma? A. Yes.

(584) J. M. W. asks if there is any known article that will clean the hands of printers of either ink or colors, without injury to the skin? A. Caustic soda or kerosene oil may be used for printer's ink. The former must be dilute or it will affect the skin unpleasantly. Other inks yield to oxalic acid, javelle water, etc.

(585) G. H. F. asks for a simple rule for reducing Fahrenheit scale to Centigrade. A. Subtract 32°, expressing degrees below 0° F. as minus quantities; multiply the result by $\frac{5}{9}$; the result will be the equivalent in Centigrade degrees.

(586) I. M. G. asks if powder, such as is used in revolver cartridges, becomes dead with age? Does any kind of powder die? I have a loaded revolver that has not been shot off for about fifteen years; would it be dangerous? A. Powder does not become dead with age. It may deteriorate by dampness. It would probably be risky to fire off your revolver, on account of deterioration of metal, rusting and clogging of the barrel, etc.; the nipples, if it is not a cartridge-loaded weapon, are probably so filled with rust, etc., that they would have to be cleaned out before discharging the piece.

(587) J. C. A. writes: 1. Can petroleum be exploded in its own volume in a strong closed vessel without a supply of air? A. Petroleum is not explosive. If placed in a vessel with a sufficient quantity of air for its combustion, it might by heating be made to give some sort of an explosion. 2. Would the pressure be increased much by introducing a certain quantity of air, and if so, how much air is requisite to do so, and how much would the pressure be increased? A. In general terms it should first be made into gas. Even then it would be hard to explode when mixed with air, because a large a proportion of air, 25 to 50 volumes, would be required, which involves the introduction of a large quantity of inert nitrogen. Quite a high pressure is developed instantaneously by these explosions, possibly as high as 100 lb. to the square inch. 3. Would the oil, or the oil and air, if kept in a strong and tight vessel, retain its pressure any length of time, or would it gradually die out? A. Pressure could be maintained for any length of time in a tight vessel.

(588) A. R. H. asks: 1. What is the best temperature to run paraffine wax at? A. 150° to 200° F. 2. What is it made from? A. Coal, shales, ozocerite, etc. 3. How to stop its shrinking or becoming hollow when it cools? A. Let it cool slowly and add more melted paraffine to supply the deficiency.

(589) C. R. C. writes: Will you please give me a receipt to color white pasteboard the color of leather, or something that will not lose its color in damp weather? A. Soak in solution of copperas and then in ammonia.

(590) E. N. S. asks: 1. Would solenoids of iron wire wound about the projecting ends of the core of an electro-magnet give good results as pole pieces? A. Not very good, from want of solidity and imperfect contact. 2. Would amalgamating the zincs of a gravity or other form of blue vitriol battery interfere with the working of the battery? If not, why are they not usually amalgamated? A. No. It is unnecessary, and hence is not done, as it would involve useless labor and expense. Your barometer would not work as you describe. Study hydrostatics, and you will see where the fallacy occurs.

(591) W. A. S.—The mineral sent is magnetic iron ore. Try it with a magnet, and you will find the powder adhere.

(592) O. T. asks whether common fertilizing bone dust is burned into charcoal, or is it used without burning? A. No; it is used as ground. 2. Is it injurious to vegetables, especially potatoes? A. No; it is beneficial. 3. What is the cause of so many green and bitter potatoes? A. Climatic and other conditions are, we presume, responsible.

(593) S. H. B. writes: 1. I am making a machine in which two rollers work in a liquid not quite as thin as water, but just as wet. Wooden rollers split, metal ones are too heavy. Can you give me instructions how to make them, to be waterproof, and that I can cast to shape desired, or can turn up and drill in lathe? I would like something with as low specific gravity as can be. A. We would suggest celluloid, ivory, or glass as material for your rollers. 2. I have seen in the SCIENTIFIC AMERICAN and several other valuable mechanical journals "Way to Cover Solder Marks on Brass Work;" have tried several of these wrinkles, but they will not "wrink." The sulphate of copper trick is a total failure. It makes the work black wherever there is any solder. Can you give me anything on that line of solder? A. The sulphate of copper "trick," as you term it, should have some effect, if the black deposit is polished off with a burnisher. You may cover the spots in a rather inefficient way by giving them a coating of orange shellac in alcohol.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

March 19, 1889,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Air ship, H. A. J. Rieckert ... 399,783
Anchor, Duren & Bills ... 399,853
Arm support for bookkeepers, adjustable, R. Hynitzsch ... 399,996
Axle lubricator, car, C. A. Howard ... 399,899
Bag. See Paper bag. Tobacco bag.
Bagasse furnace, W. W. Sutcliffe ... 400,016
Barrels, scuttle for, J. B. Eatman ... 399,657
Bars, machine for changing the angle of the flanges of Z and angle, W. E. Highfield ... 399,896
Basins and baths, secret supply, waste, and overflow for, W. H. Newell ... 399,691
Basket or carrier, I. J. W. Adams ... 399,811
Bath. See Portable bath.
Bearing, anti-friction, T. R. Ferrall ... 399,662
Bed, folding, L. C. Butterfield ... 399,832
Bed, spring, F. M. Jeffery ... 399,902
Bedsteads, crib attachment for, V. Fitz ... 399,660
Beehive, F. M. Clement ... 399,742
Belt fastener, W. G. Avery ... 399,963
Belts, hinge joint for electric, N. Warrell ... 399,954
Belting, G. F. Page ... 400,005
Belting, machine, G. F. Page ... 400,006
Bicycle, T. O'Brien ... 399,774
Billiard table rail and cushion, C. G. Brockway ... 400,032
Bin. See Flour bin.
Binder, temporary, J. F. Brown ... 399,737
Blower, electric blast, H. H. Blades ... 399,822
Bluing package, T. F. Conklin ... 399,974
Board. See Ironing board.
Boats in series, launching, C. W. Delon ... 399,848
Boiler. See Wash boiler.
Boiler, J. H. Cunningham ... 399,975
Boiler, J. T. Smith ... 399,941
Bolster spring for wagons, E. Cliff ... 399,838
Bolt heading machine, E. Burdsall, Jr. ... 399,828
Bolting reel, W. E. Gorton ... 399,874
Bomb, signal, R. H. Earle ... 399,854
Book, account, E. G. Stevens ... 400,014
Book carriage and protector, L. C. Leith ... 399,759
Book cover, F. F. Braillard ... 399,734
Book mark, H. L. Mehrer ... 399,768
Books, cutting attachment for check, H. R. Wilson ... 399,959
Boot tree, A. M. Moore ... 399,684
Boots and shoes, manufacture of, G. H. Clark ... 399,837
Bottle wiring machine, Schrader & Sturm ... 399,787
Bottles, spreader and stopper for, E. Pomeroy ... 399,927
Box. See Fare box. Journal box. Mail box. Paper box.
Brake. See Car brake. Vehicle brake. Wagon brake.
Brake shoe, S. Hatt ... 399,665
Brick machine, R. F. Robison ... 399,698
Bridges, rails, etc., apparatus for indicating the flexion of, O. Leuner ... 399,676
Buckle, S. C. Tucker ... 400,018
Buildings, construction of, J. E. Rankin ... 399,778
Burial case, J. H. Walker ... 399,951
Burner. See Gas burner. Hydrocarbon burner. Oil burner.
Burnishing machine, G. B. Kelley ... 399,669
Cables, electric alarm signal for, Woodring & Gilbert ... 400,028
Can filling and packing apparatus, S. L. Gregg ... 399,884
Cans, mechanical lid shutter for, B. Wesselmann ... 399,714
Car brake, C. Mayer ... 399,764
Car brake, B. L. Wright ... 400,029
Car brake, street railway, W. B. Clark ... 399,740
Car platforms, die for forging the followers of extensible railway, Reilley & Bergman ... 399,930
Car, stock, E. U. Benedict ... 399,821
Cars, switching or transferring, Armil & Sebree ... 399,815
Carcasses, device for spreading, G. P. Schmidt ... 399,933
Card for buttons or studs, C. G. Bloomer ... 399,824
Card grinding machine, S. A. Prescott ... 399,694
Carriage curtain fastener, S. P. Scott ... 399,934
Cart spring, road, F. Driffill ... 399,852
Cartridge belt, T. C. Orndorff ... 399,924
Cartridge and other belts, fastening for, A. Mills ... 399,915
Cartridges and cartridge magazines, belt for holding, A. Mills ... 399,916
Cartridges for transportation and distribution, packing, T. C. Orndorff ... 399,923
Case. See Burial case. Needle or pin case. Note case.
Cash recorder, J. M. Warner ... 399,953
Chair. See Rail chair.
Chart, percentile measurement, F. Swain ... 400,017
Churn, P. C. Barlow ... 399,728
Churn, W. D. Makemson ... 399,761
Churn closure, J. McDermaid ... 399,681
Cigar vending apparatus, W. C. Doubleday ... 399,851
Cigarettes, machine for dipping, C. H. & W. B. Whitaker ... 399,808
Cleaner. See Grain cleaner. Seed cleaner.
Clip. See Halter bolt clip. Whiffletree clip.
Clock, alarm, A. Bannatyne ... 399,725
Clock, repeating, E. Bannatyne ... 399,647
Clutch, friction, E. Boehme ... 399,733
Clutch, friction, H. Erdman ... 399,858
Coal elevator, J. Chase ... 399,835
Cocoon, apparatus for reeling silk from the, E. W. Serrell, Jr. ... 399,937
Cocoons, apparatus for separating waste floss from, E. W. Serrell, Jr. ... 399,936
Coffee, apparatus for preparing liquid, C. Wagner ... 399,803
Coffee mill, E. H. & C. Morgan ... 399,686
Coffee pot, E. B. Lobach ... 399,908
Coffin, A. Weckmiller ... 400,023
Coins, pad for convenience in handling and picking up, A. E. L. Slazenger ... 399,940
Collar, horse, W. Cosbie ... 399,841
Composing stick, Ludington & Leland ... 399,911
Concentrator, F. Sletcher ... 399,791
Condenser, ejector, N. W. Wheeler ... 399,715
Cot, folding, C. T. Segar ... 399,935
Cotton, machine for opening, cleaning, and ginning seed, J. R. Montague ... 400,002
Coupling. See Pipe couping. Thill coupling.
Cover fastener for vessels, J. H. Cassidy ... 399,834
Cultivator, J. G. Gaither ... 399,868
Cultivator, E. Landes ... 399,757
Cultivator, A. Lewis ... 399,910
Curtain attachment, J. Emmert ... 399,857
Curtain holder, Nolley & Wyatt ... 399,773
Cutter. See Meat cutter. Root cutter.
Die. See Screw cutting die.
Dish, covered, G. Jones *et al.* ... 399,753
Draught equalizer, J. P. McDowell ... 399,706
Draught evener, J. W. Gamble ... 399,982
Drawer guide, W. Horrocks ... 399,752
Dust collector, A. Gessl ... 399,984
Dust collector, T. Watson ... 399,713
Earth, apparatus for raising and moving, H. A. Carson ... 399,970
Edger, gang, H. C. Robb ... 399,931
Electric conductor, A. A. Brooks ... 399,826
Electric light support, Schardt & Jones ... 399,786
Electric machine, dynamo, J. W. Balet ... 399,646
Electric machine, dynamo, E. Thomson ... 399,840
Electric motors, friction gear for, C. J. Van Depoele ... 399,950
Electrical distribution by secondary batteries, F. King ... 399,755
Elevator. See Coal elevator. Hydraulic elevator.
End gate, wagon, E. A. Waltz ... 400,022
Engine. See Gas engine. Rotary engine. Steam engine.
Equalizer four-horse, A. C. Wilson ... 399,718
Exercising apparatus, W. Sachs ... 399,659
Explosive charge, high, J. W. Graydon ... 399,878, 399,883
Eye shade, T. H. Harrison ... 399,893
Fabrics, ornamenting, M. L. Hiller ... 399,897
Fan, power, P. Murray, Jr. ... 399,689
Fare box, T. L. Beaman ... 399,820
Fence, H. W. Barber ... 399,648
Fence, W. W. Campbell ... 399,833
Fence, E. F. Shellaberger ... 399,939
Fiber or silver, machine for forming balls of, W. B. Lee ... 399,909
Fibers, machine for cleaning vegetable, T. Villamor ... 399,802
File, newspaper, H. A. Shearer ... 399,704
Filter, A. Wilbur ... 399,957
Filter, water, J. Grant ... 399,875
Filtering apparatus, Gehrke & Wohlfahrt ... 399,983
Fire alarm circuits, coupling and automatic circuit breaker for, J. J. Cannan ... 399,738
Fire escape, W. J. Smith ... 399,709
Fish lines, sinker for, J. E. Gage ... 399,866
Flour bin, F. Sanderson ... 399,785
Fluids and semi-fluids by means of compressed air, forcing, Johnson & Hutchinson ... 399,994
Flush tank, J. Lawson ... 399,674
Food warmers, cup for, S. Clarke ... 399,741
Frame. See Lantern frame.
Fruit driers, rotary fan for, J. W. Cassidy ... 399,973
Fruit grader, V. Rattan ... 399,779
Furnace. See Bagasse furnace.
Furnace for working zinc ores, L. Kleemann ... 399,995
Furnace grate, M. H. Moskovits ... 399,688
Furnaces, etc., rotary bottom or grate applicable to, W. J. Taylor ... 399,797
Fuse for ordnance shells, electrical, J. W. Graydon ... 399,879
Fuses, circuit closing device for electrical torpedo, J. W. Graydon ... 399,876
Gauge. See Siding gauge.
Game apparatus, Rogers & Bartlett ... 400,011
Game wheel, G. Wilkening ... 399,717
Gas burner, W. P. Tibbens ... 399,948
Gas engine, S. Lawson ... 399,907, 399,906
Gas, making, W. J. Taylor ... 399,798
Gas producer, W. J. Taylor ... 399,793 to 399,796, 399,799
Gasogene or apparatus for making aerated beverages, L. G. & S. M. Chinnery ... 399,739
Gate. See End gate. Railway gate.
Gate, M. W. Foster ... 399,981
Generator. See Steam generator.
Gluten and starch, obtaining, H. Barker ... 399,727
Governor, steam engine, O. H. Castle ... 399,658
Grain binder, J. F. Seiberling ... 399,703
Grain binders, tension device for, J. S. Gibbs ... 399,872
Grain cleaner, H. Bryan ... 399,827
Grain sampler, B. F. Morningstar ... 399,687
Grater, nutmeg, C. O. Blood ... 399,523
Gun, revolving pneumatic, J. W. Graydon ... 399,882
Halter bolt clip, C. C. Schwaner ... 399,788
Hammock suspension device, J. D. Pritchard ... 399,998
Harrow, C. E. Bement ... 399,731
Harrow and cultivator, rolling, A. J. Adamson ... 399,644
Harvester reel, A. O. Carman ... 399,652
Harvesters, shock forming table for corn, A. N. Hadley ... 399,988
Hat and clothes rack, Brechbill & Ensign ... 399,825
Hat sweat band, W. F. Beardslee ... 399,729
Hay rake, horse, J. M. McClintock ... 399,765
Heater. See Lunch heater.
Heel nailing machine, J. H. Pope ... 399,777
Hinge, L. V. Benet ... 399,964
Hinge, R. E. Nolley ... 400,003
Hinge, friction, E. Haines ... 399,751
Hitching post, B. G. Knapp ... 399,904
Holder. See Curtain holder. Knife blade holder. Spool holder. Tumbler holder. Twine holder. Vignette holder.
Hook. See Suspender hook.
Horse blanket, A. H. Kinder ... 399,672
Horse checking device, F. T. Aikins ... 399,961
Horse checking device, W. P. Smith ... 399,708
Hose nozzle, J. Clifford ... 399,654
Huller. See Pea huller.
Hydraulic elevator, electrically controlled, C. Whittier ... 399,716
Hydrocarbon burner, F. B. Meyers ... 399,770
Indicator, alternate current, Thomson & Wightman ... 399,801
Inhaler, E. Jahr ... 399,901
Inhaler and respirator, C. Breuillard ... 399,736
Inkstand, E. Davis ... 399,844
Insecticide composition, T. Manahan ... 399,999
Internasal tube, D. H. Goodwillie ... 399,985
Iron into malleable iron or steel, converting crude, G. L. Robert ... 400,010
Ironing board, H. C. Perry ... 399,925
Ironing table, A. Riersen ... 400,009
Journal box, W. W. Worswick ... 399,721
Knife blade holder, S. V. Ellis ... 399,855
Ladder and scaffold attachment, extension, I. H. Rasor ... 400,008
Lamp socket, incandescent electric, C. E. Egan ... 399,748
Lantern frame, F. D. Spear ... 399,944
Lantern, tubular, W. Westlake ... 399,807
Last, J. W. Lamphier ... 399,906
Leather dressing, J. J. Hayward ... 399,893
Level, plumb, A. B. Ewing ... 399,859
Lock. See Nut lock. Seal lock.
Lock for trunks, etc., J. J. Sager ... 399,784
Locomotive for single rail railways, A. Mallet ... 399,679
Loom for weaving unspun plant stalks, P. De Hemptinne ... 399,745
Loom picker check, Davidson & Bannister ... 399,656
Loom stop motion, J. J. McComish ... 399,917
Lubricator. See Axle lubricator.
Lumber rack, G. Streich ... 400,015
Lunch heater, T. O'Mahony ... 399,922
Machinist's blocking, C. E. Pollard ... 399,926
Mail bag fastening, J. S. Goodwin ... 399,986
Mail box and pouch, W. Wieck ... 400,026
Mattresses, etc, woven wire, D. H. & J. F. Gail ... 399,867
Measuring wheel, rotary, R. J. Buchanan ... 399,906

Meat cutter, A. Shepard ... 399,790
Mechanical movement, Dodson & Richards ... 399,746
Medicine, catarrh remedy, P. S. Cheshier ... 399,886
Metal, device for upsetting and bending, M. Kennedy ... 399,903
Metallic wheel, T. Hill ... 399,989
Mill. See Coffee mill.
Mouldings, machine for turning, J. F. Gebhardt ... 399,871
Mouldings to be polished, reciprocating table for holding, L. Malchaw ... 399,762
Mortar, grinding and amalgamating, G. W. White 399,909
Motor. See Steam motor.
Mowing machine sections, apparatus for tempering, L. L. Lamb ... 399,673
Musical instruments, tuning pin for, V. Von Frankenberg ... 399,712
Nail, A. S. Wall ... 399,804
Needle or pin case, R. Wheatley, Jr. ... 399,856
Note case, banker's and merchant's, J. R. T. Hall ... 399,885
Numbering machine, J. D. Humphrey ... 399,991
Nut lock, H. H. Allen ... 399,813
Nut lock, A. Rasslnier ... 399,686
Obstetrical forceps, A. C. Gallano ... 399,749
Oil burner, spray, W. C. Fisk ... 399,884
Ore separator, A. Emmons ... 399,658
Paper bag and twine holder, C. E. Kemble ... 399,671
Paper bags, making striped, Dean & Roble ... 399,846
Paper box, Diemer & Gonon ... 399,849
Paper box, G. W. T. Harley ... 399,891
Paper cutting machines, clamping apparatus for, G. Daniels ... 399,743
Paper folding machine, F. L. & S. G. Goss ... 399,987
Patterns, machine for cutting, J. W. Dearing ... 399,847
Pavement, F. C. Ross ... 399,932
Pavement or roadway, H. Steinberg ... 400,013
Pea huller, Scott & Chisholm ... 399,702
Pencil sharpener, D. Codd ... 399,839
Photographic proofs and copies, mounting and preserving, D. K. Zumwalt ... 400,031
Piano, G. Steck ... 399,710
Pin. See Safety pin.
Pipe coupling, T. Flesher ... 399,661
Pipe elbow, sheet metal, Gordon & Gilbert ... 399,664
Pipe moulding apparatus, A. C. Bruce ... 399,651
Pipes, thimble for coupling lead and cast iron, L. Wolff ... 399,720
Plane, bead, J. F. Lewallen ... 399,760
Planing machine, W. E. Davis ... 399,977
Planing machine, M. Stixrud ... 399,711
Planing machine cutter head, V. T. Lawrence ... 399,758
Planter, hand seed, J. E. Shaw ... 399,938
Plow, sulky, C. Anderson ... 399,814
Portable bath, S. S. Burr ... 399,968
Portfolio, A. G. Dyrenforth ... 399,979
Post. See Hitching post. Signal post.
Pot. See Coffee pot.
Power, pneumatic device for transmitting, W. G. Scott ... 399,789
Pressure regulator, J. C. Glass ... 399,863
Printing newspapers or pamphlets, J. L. Firm ... 399,659
Projectiles, tail guide for, J. W. Graydon ... 399,880
Pruning shears, J. B. Gascoigne ... 399,869
Pump and condenser, duplex, J. Reid ... 399,780
Punch, G. W. Southwick ... 399,943
Rack. See Hat and clothes rack. Lumber rack.
Radiator, heat, A. Peart ... 399,776
Rail chair, A. I. Wolfe ... 400,027
Railway crossing, cable, G. Provost ... 399,929
Railway, elevated, H. W. Libbey ... 399,997
Railway gate, D. C. Thomas ... 399,947
Railway switch, S. Stewart ... 399,792
Railway switch, electric, E. Blake ... 399,732
Railway trains, means for safely coupling or uncoupling the pipes of pneumatic brakes or steam heating apparatus on, B. Heimsoeth ... 399,894
Rake. See Hay rake.
Recorder. See Cash recorder.
Reel. See Bolting reel. Harvester reel.
Reel and sprinkler, combined, R. Wylie ... 400,030
Refrigerator, N. Davis ... 399,976
Regulator. See Pressure regulator.
Rendering, F. Winter ... 399,810
Road sweeping machine, Carter & Keeble ... 399,971
Rolling train, universal, W. Bansen ... 399,726
Root cutter, W. H. Asbury ... 399,816
Rotary engine, Venables & Hughes ... 400,021
Rotary engine, C. Ward ... 399,952
Sad iron heating apparatus, J. M. Wishart ... 399,960
Saddle, harness, F. Rehkopf ... 399,697
Saddle hub and ferrule combination, M. F. Dolan. 399,850
Safety pin, W. F. Hyatt ... 399,667
Sash balance, Q. Baldwin ... 399,963
Sash, machine for bending metal, W. F. Mills ... 399,683
Saw attachment, hand, N. W. Rasnicke ... 399,695
Saws, machine for gumming and sharpening gin, T. H. Nance ... 399,919
Sawing machine, R. H. Hoyt ... 399,900
Scale, automatic grain, J. Locher ... 399,678
Scale, weighing, L. C. Farmer ... 399,860
Scales, weighing, J. T. Friend ... 399,865
Scarf tip, E. S. Bellows ... 399,730
Scraper, foot, W. H. Tyler ... 400,019
Screw cutting die, T. L. Smith ... 399,707
Seal lock, C. Zwickart ... 399,722
Seed cleaner, cotton, C. Baumgarten ... 399,819
Separator. See Ore separator.
Sewer trap, D. H. Donaldson ... 399,978
Sewing machine, Bartlett & Wiggin ... 399,818
Sewing machine, House & Dimond ... 399,990
Sewing machine, overedge, D. R. Dawson ... 399,744
Sewing machine shuttle driving mechanism, L. Schultz ... 399,701
Sewing machine take-up device, Moore & Davis. 399,685
Sewing machine take-up mechanism, J. Tripp ... 399,949
Sewing machines, guiding attachment for, H. C. Goodrich ... 399,873
Shaping material to the arc of any desired circle, device for, P. Leeds ... 399,675
Shearing and clipping machine, T. A. Martin ... 399,768
Shears. See Pruning shears.
Shell, J. W. Graydon ... 399,881
Shell, high explosive, J. W. Graydon ... 399,877
Shirt, S. Miller ... 399,914
Shoeing stand, J. J. Halstead ... 399,996
Shutter fastener, J. A. Bachman ... 399,724
Siding gauge, S. G. Hosack ... 399,998
Sifter, G. H. Fountain ... 399,862
Signal post, J. T. Hambay ... 399,889
Sleigh, W. J. Hamill ... 399,890
Sleigh knee, T. G. Mandt ... 399,913
Smoke consumer, A. C. Badan ... 399,817
Snow plow, E. M. Hesselbom ... 399,805
Spool holder, T. W. Norton ... 399,921
Spool stand, V. Meiss ... 399,769
Spring. See Bolster spring. Cart spring. Vehicle spring.
Stand. See Shoeing stand. Spool stand.
Stave making machine, W. L. Kellogg ... 399,670
Steam engine, N. Nilson ... 399,771
Steam generator, T. J. Reynolds ... 399,781
Steam motor, O. Noll ... 399,772
Stereoscope, A. E. Foutch ... 399,862
Stone, etc., implement for cutting, J. W. Maloy ... 399,688
Stone planing machine, W. E. Sidnell ... 399,705
Stove, W. B. Ginnis ... 399,767
Stove, combined box and cooking, J. McMaster ... 399,918
Stove for heating sad irons, J. B. Winter ... 399,719
Strap, trace, and lace trimmer and cutter, J. Bradley ... 399,965
Strength tester, coin-controlled, G. Soeding ... 399,942
Submarine vessel, Poore and Storey ... 399,693
Suspender hook, E. F. Paramore ... 399,775
Switch. See Railway switch.
Switch mechanism, J. T. Hambay ... 399,888
Table. See Billiard table. Ironing table.
Tablet, combined paper and envelope, R. W. Burns ... 399,830
Tablet, envelope, R. W. Burns ... 399,829
Tag, combination, W. H. Lemon ... 399,756
Tag, shipping, F. R. Alderman ... 399,812
Tank. See Flush tank.
Tea kettle, Dakin & Drullard ... 399,843
Telephone transmitter, C. A. Hitchcock ... 399,666
Testing machine, W. J. Keep ... 399,754
Thill coupling, F. J. Miller ... 399,682
Ticket, railway, J. Culton ... 399,842
Tobacco bag, self-closing, C. W. Van Alstine ... 400,020
Tongues, etc., metal blank for vehicle, C. M. Carnahan ... 399,969
Tool, combined, G. H. Brooks ... 399,649
Toy, musical, D. A. A. Buck ... 399,967
Trap. See Sewer trap.
Trimmer. See Strap, trace, and lace trimmer.
Truck, E. Shanks ... 400,012
Trunk securing guard attachment, J. Ware ... 399,805
Tube. See Internasal tube.
Tubes, making beaded, S. R. Wilmot ... 400,025
Tumbler holder, J. W. Gaskill ... 399,870
Turnstile, coin controlled, H. Casper ... 399,972
Twine holder, P. F. Saul ... 399,700
Type, die for trimming, M. G. Merritt ... 400,001
Type, making, M. G. Merritt ... 400,000
Type wheels and other curved surfaces, moulding, E. L. Tarbox ... 399,945
Undertaker's use, canopy table for, M. E. Welsh .. 400,024
Valve for water gauges, automatic safety, Bray & Nickerson ... 399,735
Valve, stop or throttle, F. W. Richey ... 399,782
Valve, tank and water, W. H. Newell ... 399,692
Valve, tank or water, W. H. Newell ... 399,690
Vehicle brake, A. Jeenel ... 399,668
Vehicle spring, J. R. Linton ... 399,677
Vehicle spring, J. W. Wetmore ... 399,955
Vehicle, two-wheeled, I. Brown ... 399,650
Vignette holder, A. L. Geer ... 399,750
Wagon brake, B. Wilcox ... 399,958
Wagon, coal, H. P. Wayman ... 399,806
Walls, finishing compound for plastered, T. J. Neavitt ... 399,920
Wash boiler, Poore & Martin ... 400,007
Wash boilers, fountain attachment for, G. W. Day ... 399,845
Washing machine, H. H. Fisher ... 399,980
Watch bow fastening, F. G. Faxon ... 399,861
Watch case bow, J. H. Cooper ... 399,840
Watchmaker's and jeweler's pliers, J. Daniels ... 399,655
Water closet valve, E. L. Knight ... 399,905
Well head, driven, J. Edwards ... 399,747
Wheel. See Game wheel. Measuring wheel. Metallic wheel.
Wheelbarrow, J. Annin ... 399,728
Whiffletree clip, W. W. Burson ... 399,831
Wick adjusting mechanism, C. H. Lyman ... 399,912
Windmill, W. H. Aldrich ... 399,645
Windmill, G. W. Haines ... 399,887
Windmill, C. E. Olds ... 400,004
Wire tightener, Taylor & Clark ... 399,946
Wire twisting machine, J. W. Eisenhart ... 399,856
Wool fat, refining, H. W. Langbeck ... 399,906
Zinc from ores containing precious metals, extracting, H. B. Slater ... 399,706
Zinc, manufacturing, H. A. Hunicke ... 399,992

DESIGNS.

Collar, C. W. Dater ... 18,965
Desk, F. A. Coffin ... 18,964
Hanging stand, J. L. Leavitt ... 18,972
Mirror frame, H. Berry ... 18,963
Revolver handle, C. A. Davis ... 18,966
Screw head, E. G. Soltmann ... 18,973
Type, C. E. Heyer ... 18,967, 18,968
Type, E. Lauschke ... 18,969 to 18,971

TRADE MARKS.

Boots and shoes, Parker, Holmes & Co. ... 16,401
Cartridges, shotgun, Chamberlin Cartridge Company ... 16,390, 16,391
Cigars, A. F. Garcia ... 16,393
Cigars, W. Schliep ... 16,407
Cotton linings, Burton Bros. & Co. ... 16,388, 16,389
Emmenagogue, tonic, W. T. Batterson et al. ... 16,386
Febrifuges or fever curatives, Farbenfabriken, vormals Fr. Bayer & Co. ... 16,392
Heel shaves, V. Snell ... 16,408
Horseshoe nails, S. G. Winternitz & Bro. ... 16,412
Hose, metal covered, rubber and cotton, Revere Rubber Company ... 16,403
Hose, rubber, linen, or cotton, Revere Rubber Company ... 16,404
Linings and summer coatings, C. E. Parkinson & Co. ... 16,409
Meats, vegetables, fruits, oysters, and fish, L. P. Haviland & Co. ... 16,396
Medical compounds to cure diseases of the nerves, liver, and stomach, H. R. Rogers ... 16,406
Medicinal petroleum products, Terraline Company ... 16,410
Medicinal preparation for the treatment of general debility and brain and nerve diseases, R. D. Lalor ... 16,399
Metal working tools, brass and copper supplies, and platers' and polishers' supplies, C. H. Besly & Co ... 16,387
Nervine, S. A. Richmond ... 16,405
Newspaper or weekly pamphlet, Kansas City Times Newspaper Company ... 16,398
Petroleum, refined, A. Hoppe & Sons and S. Banner & Co. ... 16,397
Pipes, die plates for threading steam, gas, and other, Walworth Manufacturing Company ... 16,411
Remedies, external, J. H. McGuinness ... 16,400
Stitching horses, Randall & Co. ... 16,402
Washboards, C. D. & F. D. Fuller ... 16,394, 16,395

A Printed copy of the specification and drawing of any patent in the foregoing list will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated, the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

FOREIGN PATENTS

THEIR COST REDUCED.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad.

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law, which went into force on Jan. 1st, 1885, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well projected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India Australia, and the other British Colonies.

An experience of FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each, and othe information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

Address, MUNN & CO.,
Publishers and Patent Solicitors,
361 Broadway, New York.

BRANCH OFFICES: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

The Scientific American

PUBLICATIONS FOR 1889.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly), one year	$3.00
The Scientific American Supplement (weekly), one year.	5.00
The Scientific American, Export Edition (monthly) one year.	5.00
The Scientific American, Architects and Builders Edition (monthly), one year.	2.50

COMBINED RATES.

The Scientific American and Supplement,	$7.00
The Scientific American and Architects and Builders Edition,	5.00
The Scientific American, Supplement, and Architects and Builders Edition,	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of

MUNN & CO., 361 Broadway, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

RIDE CYCLES!

VICTORS ARE BEST!

Bicycles, Tricycles, and Safeties.

Send for free illustrated Catalogue.

Overman Wheel Co., Makers, BOSTON, MASS.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 632. Price 10 cents. To be had at this office and from all newsdealers.

JENKINS' AUTOMATIC AIR VALVE

We do away with the expansion of metal, and depend on an expansible elastic plug of Jenkins Packing, made specially for the purpose, thus insuring a perfect seat.

PRICES, PER DOZEN.
Finished & Nickel Plated, $7.50
Drip Cups for same, - - 2.00

JENKINS BROS., 71 John St., N. Y.; 105 Milk St., Boston; 21 North 5th St., Phila.; 54 Dearborn St., Chicago.

Springfield Roadster.

B·I·C·Y·C·L·E·S.

Superior High-Grade Safety Wheels of both high and low styles, unequaled in Material, Workmanship, Durability, and Beauty, and sold at from

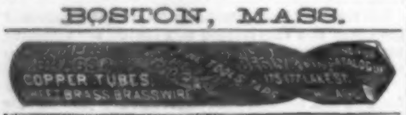
$15 to $25 CHEAPER

than any other high-grade wheels in the market.

Descriptive catalogue of all of our Wheels free on application.

Springfield Bicycle Mfg. Co.

No. 178 Columbia Avenue, BOSTON, MASS.



Steam! Steam!

Quality Higher, Price Lower.

For Strictly Cash. Complete Fixtures except Stack.

2-Horse Eureka Boiler and Engine, - $135
4- " " " " " - 210

Other sizes at low prices. Before you buy get our prices.

B. W. PAYNE & SONS,
Drawer 56. ELMIRA, N. Y.

The ECLIPSE HYDRAULIC ELEVATOR

Simple, Durable, Economical, and Absolutely Safe.
Cannot fail or freeze.

Tuerk Hydraulic Power Co.
New York. Chicago.

WOOL HAT MAKING.—FULL DEscription of the process.—Wool washing, carding and forming, settling, bumping and washing out, stretching or stamping, drying, storing and steaming, pulling out, dyeing, blocking, storing, pressing, finishing, rounding, curling and ironing, paring, trimming and shaping, velouring etc. With 20 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NOS. 626, 628, and 629. Price 10 cents each. To be had at this office and from all newsdealers.

MUNSON'S PORTABLE MILLS, AND MILL FURNISHINGS,
MANUFACTURED BY MUNSON BROTHERS, UTICA, N. Y., U. S. A.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

THE BRIDGEPORT WOOD FINISHING CO

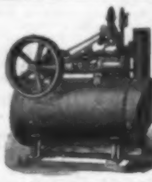
G. M. BREINIG, AGENT. PRINCIPAL OFFICE AT MANUFACTORY NEW MILFORD, CONN.
NEW YORK OFFICE 240 PEARL ST. MANUFACTURERS OF
CHICAGO OFFICE & WAREHOUSE 200 EAST RANDOLPH

WHEELERS PATENT WOOD FILLER.

BREINIGS LITHOGEN SILICATE PAINT
LITHOGEN PRIMER. WOOD STAINS
SILEX FLINT AND FELDSPAR.

PAMPHLET GIVING DIRECTIONS FOR FINISHNG HARD WOOD FREE TO ANY ADDRESS.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.



STEAM ENGINES

Upright and Horizontal, Stationary, Portable and Semi-Portable.
8 to 16 Horse Power.
Illustrated Pamphlet Free. Address
JAMES LEFFEL & CO.
SPRINGFIELD, OHIO,
or 110 Liberty St., New York.

Scientific Book Catalogue

RECENTLY PUBLISHED.

Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.

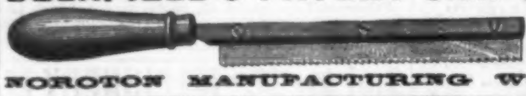
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.

THE PATENTEES OF A NEW PROCESS OF Making Cast Iron Pulleys, by which it can be done at from 35 to 45 per cent. less than by the present process, propose to license a few parties to manufacture. Address "NEW PROCESS," P. O. Box 773, New York.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's Book of SAWS. We are first to introduce NATURAL GAS for heating and tempering Saws with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa. **SAWS**

WORKING MODELS and Experimental Machinery, metal or wood, made to order by MASON & RAUCH, successors to J. F. Werner, 62 Centre Street, New York.

DELAFIELD'S PATENT SAW CLAMP.—1889 PATTERN.



Stronger than the old style. Clamp without blade, 50 cents. Metal cutting blades ½ inch wide, 7 cents each, 70 cents per dozen; 1 inch wide, 40 cents each. All postpaid. Discount to dealers. Write for Circular.

NOROTON MANUFACTURING WORKS, NOROTON, CONN.

H. W. JOHNS'

Established 1858.

Asbestos PATENTED Roofing

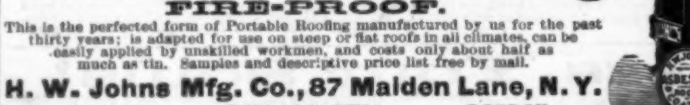
FIRE-PROOF.

This is the perfected form of Portable Roofing manufactured by us for the past thirty years; is adapted for use on steep or flat roofs in all climates, can be easily applied by unskilled workmen, and costs only about half as much as tin. Samples and descriptive price list free by mail.

H. W. Johns Mfg. Co., 87 Maiden Lane, N. Y.
CHICAGO. PHILADELPHIA. LONDON.

SOLE MANUFACTURERS OF
H. W. Johns' Liquid Paints, Asbestos Fire-Proof Paints, Sheathings, Building Felts, Asbestos Steam Packings, Boiler Coverings, etc. VULCABESTON Moulded Piston-rod Packing Rings, Gaskets, etc.

STEEL RULES and TAPES.



Engineers', Machinists', Blacksmiths', Carpenters', Tinners' Pocket Rules. Perfection Glass Boards.

THE AMERICAN BELL TELEPHONE CO.

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

INVENTORS and others desiring new articles manufactured and introduced, address P. O. Box 86, Cleveland, O.

JAMES B. EADS.—AN ACCOUNT OF the life and labors of this eminent engineer. With a portrait. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 592. Price 10 cents. To be had at this office and from all newsdealers.

MACHINISTS' SUPPLIES LATHES, CHUCKS, DRILLS, TOOLS, SCREWS
SEND 13 CENTS FOR ILLUSTRATED CATALOGUE
MONTGOMERY & CO. 105 FULTON ST. N.Y.

ETHEREAL OILS, NOTES ON.—NAture and occurrence, preparation, properties, composition. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 639. Price 10 cents. To be had at this office and from all newsdealers.

WIRE ROPE

Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.

Wheels and Rope for conveying power long distances. Send for circular.

THE INTERNATIONAL CYCLOPEDIA

The SCIENTIFIC AMERICAN comes to the "INTERNATIONAL" for answers to its questions.

"It will answer more questions than any other." Geo. R. Howell, State Library, Albany, N. Y.

WHAT THIS CYCLOPEDIA BRINGS TO ITS POSSESSOR.

KNOWLEDGE OF ALL

ARTS, SCIENCES, HISTORY, CUSTOMS, RELIGIONS, LITERATURE, PEOPLES, NATIONS, GOVERNMENTS.

SALESMEN WANTED. EASY TERMS OF PAYMENT.

Address **DODD, MEAD & COMPANY, Publishers,** 753 & 755 Broadway, New York.

SYRACUSE MALLEABLE IRON WORKS
W. B. BURNS, PROP.

CHANGE OF NAME.

As the "Charter" Gas Engine is the specialty of manufacture of this company, and the name of The Williams & Orton M'f'g Co. conveys no idea of our business, and the parties that furnished that name have not been connected with the company for years, it was considered desirable to change the title of this corporation to The Charter Gas Engine Company, which has been done.

The great popularity of the "Charter" Gas Engine justifies giving its name and the name of its inventor and patentee to the company that manufactures and sells it.

Thanking you in behalf of the discarded title for your favors, and trusting that under the new we will receive your further valued patronage, we are,
Very respectfully,

THE CHARTER GAS ENGINE CO.,
P. O. Box 148. Sterling, Illinois.

We beg to say that we will continue the manufacture and sale of Wire Rope Transmissions, Portable Mills, Pulleys, Shafting, Couplings, Hangers, Boxes, Gearing, Tighteners, etc., etc., on which line we flatter ourselves that the name of "Williams & Orton goods" is familiar to many, and stands for "the best."

MALLEABLE AND FINE GRAY IRON, ALSO STEEL CASTINGS FROM SPECIAL PATTERNS. FINE TINNING, JAPANNING AND FINISHING.
THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA.

PNEUMATIC DYNAMITE TORPEDO Gun.—An exhaustive account of this new weapon and of the experiments made with it; along with a description and illustration of a proposed dynamite cruiser. With 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 593. Price 10 cents. To be had at this office and from all newsdealers.

ERIE ENGINE WORKS WALNUT STREET, ERIE, PA. MANUFACTURERS OF STATIONARY, PORTABLE, AGRICULTURAL, STATIONARY, PORTABLE, VERTICAL BOILERS.

KEY SEATING Machines and 20" Drills. W. P. DAVIS, Rochester, N. Y.

THE

Scientific American

ESTABLISHED 1845.

The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete List of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE

Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies 10 cents. Address and remit by postal order, express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid **Magazine of Architecture**, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.